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# ROADS and STREETS

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## GRADED SOIL MIXTURES FOR ROAD SURFACE AND BASE COURSES

By EDWARD A. WILLIS

Associate Highway Engineer,  
U. S. Bureau of Public Roads

**D**URING the past year many miles of stabilized road surface and base courses have been built and added to the large number of such projects already in service.

The methods of soil stabilization utilized depend on the material locally available. In some locations, such as the southeastern part of the United States, nature provided deposits of materials having characteristics required in the best of soil roads and base courses. In other locations, binder soils and aggregates are available for producing mixtures having the properties of the best naturally good soils. At times materials are available for the gradations required in roads, but the binder soil may be of inferior quality. Finally, there are locations where there is a deficiency of the aggregate required for properly graded mixtures, in which case it is necessary to import granular materials or to resort to the portland cement, asphaltic, or tar binders to provide stable base courses for thin bituminous surfacings.

### Suitability

Experience has shown that roads that were highly stable before surface treatment might become unstable when covered with a waterproof surfacing. The American Association of State Highway Officials recognized the necessity of separating the graded soil mixtures and has adopted specifications for both surface courses (M-61-38) and base courses (M-56-38). The types of materials suitable for use in the two groups are similar in most respects, but have some marked differences as indicated in the essential requirements of these specifications which follow:

#### 1. Surface courses

##### Type A—Sandy-clay mortar:

Passing	Percentage by weight
1-in. sieve .....	100
No. 10 sieve .....	65-100

The material passing the No. 10 sieve should have gradings as follows:



*The Value of Judicious Selection of Materials Illustrated at an Intersection on Virginia Route 218.*



Smoothing Operation During the Construction of a Graded-Mix Type Road in Indiana.

Passing	Percentage by weight
No. 10 sieve.....	100
No. 20 sieve.....	55- 90
No. 40 sieve.....	35- 70
No. 200 sieve.....	8- 25

Type B.—Coarse-graded aggregate:

Passing	Percentage by weight
1-in. sieve .....	100
¾-in. sieve .....	85-100
½-in. sieve .....	65-100
No. 4 sieve.....	55- 85
No. 10 sieve.....	40- 70
No. 40 sieve.....	25- 45
No. 200 sieve.....	10- 25



A Windrow Evener in Use in Nebraska.

Type C.—Crusher-run materials:

Passing	Percentage by weight
¾-in. sieve .....	100
No. 4 sieve.....	70-100
No. 10 sieve.....	35- 80
No. 40 sieve.....	25- 50
No. 200 sieve.....	8- 25

The fractions of surface course materials, A, B, and C, passing the No. 200 sieve should be less than  $\frac{2}{3}$  of the fraction passing the No. 40 sieve. The fraction passing the No. 40 sieve should have a liquid limit not greater

than 35 and a plasticity index not less than 4 nor more than 9.

2. Base course

Type A.—Sand-clay mortar:

Passing	Percentage by weight
No. 10 sieve.....	100
No. 20 sieve.....	55- 90
No. 40 sieve.....	35- 70
No. 200 sieve.....	8- 25

Types B-1 and B-2.—Coarse-graded aggregate:

	B-1	B-2
1-in. max. size	2-in. max. size	
Passing	Percentage by weight	
2-in. sieve .....		100
1½-in. sieve .....		70-100
1-in. sieve .....	100	55- 85
¾-in. sieve .....	70-100	50- 80



Checking the Quantity of Windrowed Material in Nebraska.

¾-in. sieve .....	50- 80	40- 70
No. 4 sieve.....	35- 65	30- 60
No. 10 sieve.....	25- 50	20- 50
No. 40 sieve.....	15- 30	10- 30
No. 200 sieve.....	5- 15	5- 15

Type C.—Crusher-run materials:

Passing	Percentage by weight
¾-in. sieve .....	100
No. 4 sieve.....	70-100
No. 10 sieve.....	35- 80
No. 40 sieve.....	25- 50
No. 200 sieve.....	8- 25

The fraction of base course materials, A, B, and C, passing the No. 200 mesh sieve should be less than  $\frac{1}{2}$  of the fraction passing the No. 40 sieve. The fraction



Plant-Mixed Materials Placed on the Roadbed Ready for Spreading.

passing the No. 40 sieve should have a liquid limit not greater than 25 and a plasticity index not greater than 6.

### Circular Track Tests Conducted by Bureau of Public Roads

Results<sup>1</sup> of tests performed by the Bureau of Public Roads using a small circular track support the validity of the A.A.S.H.O. base course specifications. In these tests mixtures covering a wide range in grading and plasticity index were tested as base courses under thin bituminous surfaces with varying conditions of moisture and traffic application.

The investigations resulted in a quite definite classification of the materials studied as to their ability to withstand the disruptive action of traffic under unfavorable moisture conditions and indicated that to guard against unsatisfactory behavior it is necessary to control both the plastic properties and the grading of the soil materials. Excellent behavior was observed in all materials meeting the A.A.S.H.O. Specifications. Wherever the materials departed materially in grading and plasticity index values from these requirements, instability in the base course became evident.



*A Well Proportioned, Graded Mixture Used in Minnesota. The Proper Amount of Water for Compaction Has Been Added. The Photograph Was Taken After One Pass With a Multiple-Wheel Roller.*

In general the investigations showed that well-graded materials having a low but measurable plasticity index are to be preferred to absolutely nonplastic materials of comparable grading and are decidedly superior to those having appreciably higher plasticity indexes.

These tests further indicated the necessity for adequate compaction to bring out the full inherent stability of granular mixtures. Materials otherwise satisfactory became temporarily unstable in the presence of water unless they were compacted to essentially their maximum density during construction. Excellent results were obtained by adding a slight excess of water and continuing compaction during the dry period. Compaction of base courses having plastic properties should be completed before surfacing courses are applied because movements in base courses that are common during compaction of good materials will cause damage to prematurely constructed surfacing courses.

### Design Practice

Discussions at the last meeting of the Department of Soils Investigations of the Highway Research Board indicated that, with some exceptions, requirements not greatly different from the A.A.S.H.O. Specifications were widely employed and that there was a definite trend toward the use of lower plasticity indexes particularly in

<sup>1</sup>A Study of Sand-Clay Materials for Base Course Construction by C. A. Carpenter and E. A. Willis, *Public Roads*, vol. 19, no. 9, November, 1938.

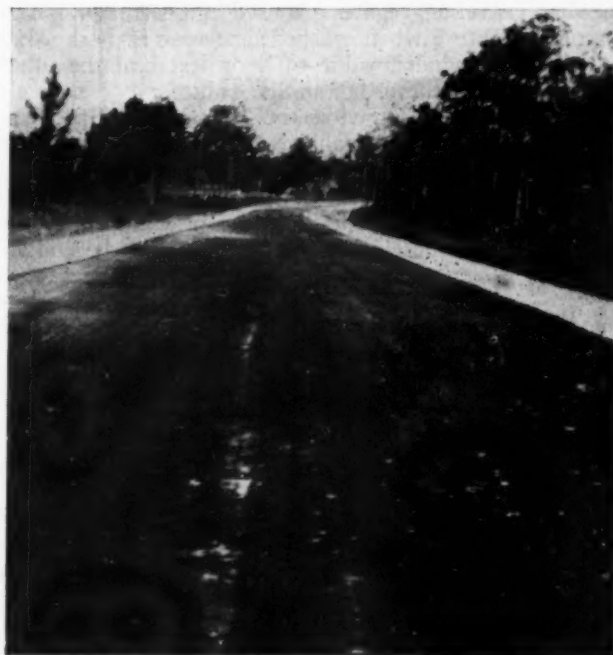


*A "Homemade" Briner for Dissolving Sodium Chloride for Use in the Construction of a Graded-Mix Type Road in Indiana. The Pile in the Foreground Is Rock Salt.*

base course construction. Greater variation was encountered in the design of surfaces than in base courses and certain local materials of known service value were used successfully without strict adherence to grading and plasticity index requirements.

Thus the practice in Georgia and Alabama was to utilize topsoil, sand-clay, sand-clay gravel and pebble soil wherever satisfactory deposits of such materials are available without resorting to the plasticity tests to determine the quality of the soil binder. Care was taken, however, to secure materials which have low shrinkage properties. In these same states it has been found necessary to use caution when selecting charts for road building purposes since excessive plasticity in the active binder portion has repeatedly been associated with failure.

The North Carolina Highway Department reported the use of well-graded materials having plasticity indexes between 3 to 10 in the construction of the graded-mix type



*Limerock Base Course in Georgia. This Base Has Been Covered with a Thin Bituminous Surface Treatment.*





*A Graded Mix-Type Road Built of Local Materials by Mr. C. M. Upham on His Estate Near Washington. This Road Received a Surface Application of Calcium Chloride.*

road surfaces and plasticity indexes less than 6 for base courses in that State.

Pennsylvania adheres to rigid specifications in the proportioning of the soil mortar, that fraction of the total mixture passing the No. 10 sieve, and utilizes the most readily available coarse aggregate. Among the aggregates used are gravel, stone, shale, cinders, "red dog" and the like, many of which may be secured locally at relatively low cost. By means of careful job control employing testing procedures adapted to field use, this State has built roads conforming to their grading requirements and having plasticity indexes within the ranges of 0 to 6 for both surface and base courses.

Missouri, Michigan, Indiana and Nebraska also reported the necessity of close control of the plasticity index. Indiana required a plasticity index of from 1.5 to 4.5 when gravel aggregates are used and permits a variation of only 0 to 3 when crushed limestone is used. Missouri recommended a value of 4 or less and the other reports indicated the use of similar values.

It is significant that while the A.A.S.H.O. Specifications are generally applicable in all localities, there are some local sources from which may be obtained natural materials giving excellent service as road surface and base courses, even though they do not conform to the specifications. These materials will have to be judged



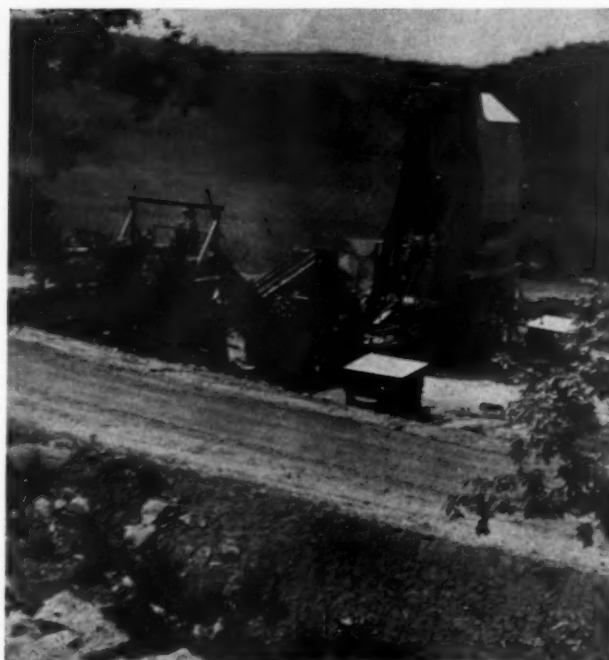
*Spreading a Plant-Mixed Graded-Mix Type Base Course Mixture in Indiana. The Spreader Travels on Side Forms as Shown. Compaction Was Obtained Later by Rolling with a Flat-Wheeled Roller.*

on local service behavior until a satisfactory test has been devised for measuring the strength and permanence of the binder.

### Chemical Admixtures

Common salt and calcium chloride have been utilized in the construction and maintenance of the graded-mix type road surface and base courses. The use of these chemicals does not in any way preclude the necessity of controlling the grading and plasticity index of the mixtures. These salts, through their water retentive properties, tend to preserve a uniform moisture content which is beneficial in (1) assisting consolidation during and immediately after construction; (2) retarding the abrasion of surface courses and thus reducing the loss of valuable road metal; and (3) minimizing or preventing the destructive raveling of nonplastic base courses during the period they are exposed to traffic without a protective surface treatment.

The chemicals have been used successfully with graded mixtures of natural materials such as bank-run gravels



*Plant Setup for Preparing a Graded-Mix Base Course Material in Indiana. The Limestone Was Quarried, Crushed and Mixed with Soil Binder, Water and Calcium Chloride at This Location.*

and with artificial mixtures in which either gravel or crushed rock constituted the coarse aggregate. Reports presented at the Highway Research Board meetings described instances where limestone screenings had been substituted for a part or all of clay soil binder with excellent results in roads which were chemically treated.

The high degree of cementation observed in these roads was attributed to the fact that limestone is more soluble in a sodium chloride or calcium chloride solution than it is in water. A number of states have found it advantageous to utilize the so-called "quarry wastes" or tailings in combination with chemicals in their graded-mix type roads.

### Construction Methods

The following summary of construction practice during the past year was prepared from the reports presented at the sessions on soil stabilization at the meeting of the Highway Research Board supplemented by observations of the writer on jobs visited.

Methods of construction varied in different parts of





*Mixed-in-Place Operations in the Construction of a Graded-Mix Type Road in Nebraska.*

the country and with different types of materials. Variations of the mixed-in-place and the plant-mix methods were employed with the latter method apparently gaining in favor, particularly on large contract jobs where its use could be economically justified.

In both types of construction essential steps included the following:

1. Proper proportioning of the constituents of the mixture to secure the desired properties.
2. Thorough mixing of the component parts to insure uniformity.
3. Spreading of the mixture to secure a smooth surface.
4. Compaction under proper moisture conditions to provide resistance to displacement.

Where suitable natural materials are not available, aggregates must be combined into a mixture which will conform to the limitations imposed by the specifications for the job. This can be best accomplished after the grading and plasticity index of the materials from all proposed sources have been determined. Several states have followed the practice of locating and testing possible aggregate and binder soil pits along the proposed right-of-way as a part of the preliminary subgrade survey. Texas has had excellent success in locating aggregates by using the resistivity method of subsurface exploration.

Where material on the roadway was to become a part of the final mixture the old roadbed was scarified. Mis-

souri reported that in many locations in that state it was possible to effect a considerable saving by crushing and utilizing the coarse material present in old road or subgrade. After scarification, new materials were deposited on the grade either in a uniform layer or in a windrow. The windrow evener has proved valuable in controlling the amounts of the various materials which were to be combined. Proportioning at a central mixing plant has been achieved in some cases by the use of weighing equipment while in others endless belts conducted the materials to the mixer in the desired proportions.

Mixing has been accomplished on the road by means of blades, discs and similar equipment or by means of traveling mixers which pick the materials up from the windrow, mix them thoroughly and deposit them on the subgrade ready for spreading. More uniform mixtures have been obtained with blades and discs by adding the water necessary for compaction near the end of the mixing operation. Most of the traveling mixers which have been used are so constructed that the desired amount of water and chemical admixture if this is used can be added as mixing proceeds.

Mixers of the drum type such as are used on concrete pavers or of the pug-mill type such as are used in preparing asphalt paving mixtures, have both been utilized in preparing graded-type mixtures where the plant-mix method is used. The plants were usually located at the quarry or gravel pit and the overburden was often used as the soil binder. The mixtures prepared at the plant contained the desired amount of water and in many cases an admixture of calcium chloride or common salt.

Spreading was usually accomplished by means of blades although on at least one job built during the past year a mechanical spreader operating on metal side forms was used. The use of a multiple blade maintainer, after initial compaction, has been found to be valuable in securing a smooth surface.

Sheepsfoot rollers, pneumatic-tired rollers and flat-wheel rollers have all been used in securing compaction. The composition of the mixture seemed to be a factor in determining the type of roller to be employed. Difficulties were encountered in using a sheepsfoot roller on a coarse graded material in one instance because the feet tended to prevent the interlocking of the aggregate particles. On other projects this type of roller has been used to great advantage.

It has been found that the action of traffic on the mixture as it dries from its original moisture content increased the density and stability of the road appreciably. Many engineers permit traffic to use the newly laid surface as soon as possible after construction in order to



*A Graded-Mix Road in New York Which Has Been Treated with Sodium Chloride.*

secure the benefits of this action. In some instances small barricades have been used to secure a uniform distribution of the traffic over the entire width of surface.

### Summary

In conclusion it can be stated that during the past year laboratory and field studies of graded mixtures and the construction of many miles of graded-mix type road surfaces and base courses have confirmed the soundness and practicability of the following principles:

1. That the control of both grading and plasticity index of the mixtures is necessary to assure satisfactory service behavior over a period of years. The specifications adopted by the A.A.S.H.O. are generally applicable in all localities but do not include certain materials of local origin which have been used with excellent results.
2. That thorough mixing is necessary to insure uniformity.
3. That the presence of a controlled amount of water, usually between 8 and 12 per cent by weight is necessary before the compacting action of traffic or rollers can produce the desired density.
4. That adequate compaction should be obtained before the construction of thin bituminous wearing courses since movements which would normally occur during the compaction of good base course materials would be sufficient to cause distress in the surface treatment.
5. That local and oftentimes inexpensive aggregates which may not be satisfactory for use in other types of highway construction can be used in graded-mix type surfaces and bases provided the mixtures are carefully designed to utilize the inherent properties of the materials to the best advantage and provided that careful control is exercised during construction.

### FUNDS APPORTIONED FOR ROADS ON PUBLIC LANDS

The Secretary of Agriculture on Dec. 30 apportioned to 15 public lands states the sum of \$1,000,000 for the improvement of main roads through unappropriated or unreserved public lands, non-taxable Indian lands, or other Federal reservations other than forest reservations. The sum apportioned is authorized for the fiscal year beginning next July by the act of June 8, 1938. States participating in the apportionment are those having more than 5 per cent of their area in lands of the above kind and the apportionment is on the basis of the areas of such lands. It is not required that these funds be matched by the states. The apportionment is as follows:

State	Sum Apportioned
Arizona .....	\$ 154,949
California .....	94,859
Colorado .....	37,837
Idaho .....	52,015
Montana .....	55,200
Nevada .....	212,442
New Mexico .....	84,982
North Dakota .....	12,925
Oklahoma .....	11,048
Oregon .....	60,542
South Dakota .....	19,763
Utah .....	108,843
Washington .....	14,512
Wyoming .....	80,083
Total .....	\$1,000,000

### HIGHWAY FUNDS APPORTIONED

The Secretary of Agriculture on Dec. 30 announced the apportionment of \$135,000,000 to aid the States in highway improvement and elimination of grade cross-

ings in the fiscal year beginning next July 1. The funds were authorized by the Federal-aid Highway Act of 1938 and consist of \$100,000,000 for improvement of the Federal-aid highway system including extensions through cities, \$15,000,000 for secondary or feeder roads, and \$20,000,000 for elimination of hazards at railroad grade crossings. The highway funds are to be matched by the States but those for grade crossings are available without matching. All expenditures are to be made in cooperation with the State highway departments. The apportionment follows:

### APPORTIONMENT OF HIGHWAY FUNDS For the Fiscal Year 1940

State	Regular Federal Aid	Secondary or Feeder Roads	Grade Crossings	Total
Alabama .....	\$ 2,068,493	\$ 310,274	\$ 393,552	\$ 2,772,319
Arizona .....	1,423,400	213,510	125,461	1,762,371
Arkansas .....	1,702,583	255,387	343,731	2,301,701
California .....	3,793,823	569,073	728,856	5,091,752
Colorado .....	1,807,919	271,188	251,215	2,330,322
Connecticut .....	624,021	93,603	167,075	884,699
Delaware .....	487,500	73,125	97,500	658,125
Florida .....	1,335,020	200,253	277,471	1,812,744
Georgia .....	2,507,151	376,073	477,283	3,360,507
Idaho .....	1,223,119	183,468	161,779	1,568,366
Illinois .....	4,043,313	606,497	1,030,486	5,680,296
Indiana .....	2,425,913	363,887	506,736	3,296,536
Iowa .....	2,542,385	381,358	545,468	3,469,211
Kansas .....	2,585,837	387,876	504,959	3,478,672
Kentucky .....	1,824,345	273,652	356,846	2,454,843
Louisiana .....	1,436,747	215,512	310,856	1,963,115
Maine .....	873,455	131,018	135,191	1,139,664
Maryland .....	821,369	123,205	200,663	1,145,237
Massachusetts ..	1,375,489	206,323	408,286	1,990,098
Michigan .....	3,012,993	451,949	649,147	4,114,089
Minnesota .....	2,704,164	405,625	524,721	3,634,510
Mississippi .....	1,746,261	261,939	310,650	2,318,850
Missouri .....	2,986,426	447,964	596,184	4,030,574
Montana .....	2,032,384	304,858	261,252	2,598,494
Nebraska .....	2,044,283	306,642	347,689	2,698,614
Nevada .....	1,275,938	191,391	97,500	1,564,829
New Hampshire ..	487,500	73,125	97,500	658,125
New Jersey .....	1,321,366	198,205	389,614	1,909,185
New Mexico .....	1,595,294	239,294	166,957	2,001,545
New York .....	4,845,924	726,889	1,335,949	6,908,762
North Carolina ..	2,321,357	348,204	500,977	3,170,538
North Dakota .....	1,532,167	229,825	309,164	2,071,156
Ohio .....	3,583,189	537,478	833,853	4,954,520
Oklahoma .....	2,317,258	347,589	455,041	3,119,888
Oregon .....	1,638,823	245,823	224,953	2,109,599
Pennsylvania .....	4,221,088	633,163	1,128,616	5,982,867
Rhode Island .....	487,500	73,125	97,500	658,125
South Carolina ..	1,328,214	199,232	293,750	1,821,196
South Dakota .....	1,610,762	241,614	268,815	2,121,191
Tennessee .....	2,079,803	311,970	373,187	2,764,960
Texas .....	6,227,084	934,063	1,088,862	8,250,009
Utah .....	1,124,731	168,710	129,236	1,422,677
Vermont .....	487,500	73,125	97,500	658,125
Virginia .....	1,815,401	272,310	373,906	2,461,617
Washington .....	1,563,815	234,572	300,063	2,098,450
West Virginia .....	1,082,034	162,305	260,716	1,505,055
Wisconsin .....	2,413,315	361,997	486,074	3,261,386
Wyoming .....	1,249,044	187,357	132,134	1,568,535
Dist. of Col. ....	487,500	73,125	97,500	658,125
Hawaii .....	487,500	73,125	97,500	658,125
Puerto Rico .....	487,500	73,125	150,076	710,701
Adm. and Eng. Reserve .....	2,500,000	375,000	500,000	3,375,000
Total .....	\$100,000,000	\$15,000,000	\$20,000,000	\$135,000,000

**CORNELL OFFERS COURSES IN MOTORWAY DESIGN**—The school of Civil Engineering of the College of Engineering and the Department of City and Regional Planning of the College of Architecture of Cornell University, Ithaca, N. Y., now offer comprehensive courses in the principles of modern motorway design utilizing the services of Walter L. Conwell, professor of highway engineering in the School of Civil Engineering, and Gilmore D. Clarke, dean of the College of Architecture and professor of regional planning.



# NEW ROAD TAR USES IN 1938

By GEO. E. MARTIN

Consulting Engineer,  
General Tarvia Department,  
The Barrett Co., New York City

**I**F THE highway industry was like the automobile industry and issued new models each year, the task of the reviewer would be much easier. Conditions being as they are in the highway industry, one must look rather closely to find the trends and discover the changes in the methods of using tar during one year. However, there have been changes and modifications in both construction and maintenance procedure.

There have been no appreciable changes in crude tar supplies or in the manufacturing and refining methods during 1938. The major portion of the tars used in highway work are manufactured to meet customer technical specifications.

## Tar Specifications

The list of tar consistencies adopted by the American Society for Testing Materials and the American Asso-



Spreading Hot Tar Mix

ciation of State Highway Officials is being rapidly adopted by the various state highway departments and by other political units.

The list of grades is as follows:

Grade	Method of Test	Consistency
RT-1	Specific viscosity, Engler at 40° C.....	5- 8
RT-2	Specific viscosity, Engler at 40° C.....	8- 13
RT-3	Specific viscosity, Engler at 40° C.....	13- 22
RT-4	Specific viscosity, Engler at 40° C.....	22- 35
RT-5	Specific viscosity, Engler at 50° C.....	17- 26
RT-6	Specific viscosity, Engler at 50° C.....	26- 40
RT-7	Float test at 32° C., seconds.....	50- 80
RT-8	Float test at 32° C., seconds.....	80-120
RT-9	Float test at 32° C., seconds.....	120-200
RT-10	Float test at 50° C., seconds.....	75-100
RT-11	Float test at 50° C., seconds.....	100-150



Dragging Sand for Retread Filler

RT-12	Float test at 50° C., seconds.....	150-220
TCB-5	Specific viscosity, Engler at 40° C.....	17- 26
TCB-6	Specific viscosity, Engler at 40° C.....	26- 40

Practice naturally varies in different parts of the country and with different customers, but in general the various grades are used for the purposes indicated in the following tabulation:

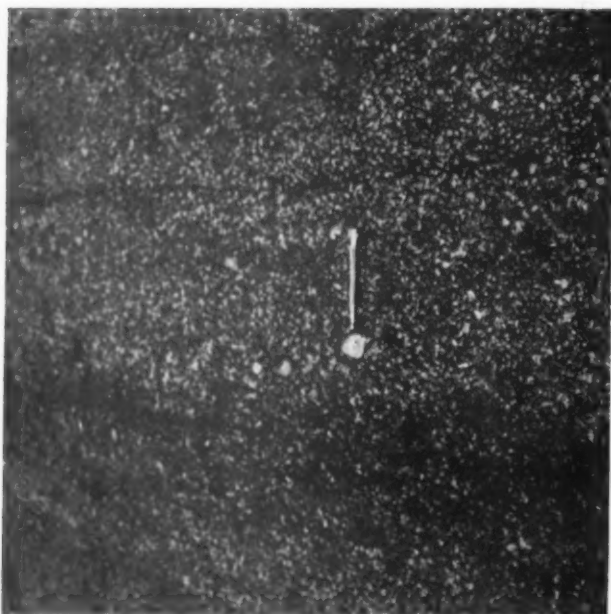
Process	Grades of Tar
Prime coat .....	RT-1, 2, 3
Stabilization .....	RT-1, 2, 3, 4, 5, 6
Cold surface treatment.....	RT-3, 4, 5, 6
	TCB-5, 6
Drag leveling course.....	RT-3, 4, 5, 6
Gravel mulch .....	RT-4, 5, 6, 7
Retread .....	RT-5, 6, 7, 8
Hot surface treatments.....	RT-7, 8, 9, 10
Cold plant mix.....	RT-7, 8, 9
Crack filler .....	RT-10, 11
Hot plant mix.....	RT-9, 10, 11, 12
Penetration macadam .....	RT-11, 12
Cold patch .....	TCB-5, 6

For practically all purposes the tendency is to use the



Sand Choke on Retread Job





*Sand Filled Retread Before Sealing*

heaviest tar which can be satisfactorily used under the weather and climatic conditions on the specific job.

#### **Surface Treatments**

Changes in traffic conditions have forced changes in surface treating operations. Even a few years ago we had high pressure tires on automobiles which moved at a comparatively low rate of speed. Some solid tire trucks were operating on the roads. The effect of this traffic was similar to the rolling done as a part of the surface treating operations. The aggregate was pushed into the tar and the plastic tar was forced up around the lower part of the aggregate particles. Times have changed, however. The present low-pressure, large-diameter automobile tires and the pneumatic truck tires no longer assist in holding the cover on the road surface but start to tear it out as soon as the road is opened to traffic. As a result the amount of tar used per square yard for



*Sand Filled Retread Job in New York State*

surface treatments has been slightly increased. The size of covering aggregate has been reduced so that it can be more readily held by the tar. The tendency also is to use a graded aggregate for cover so that a tight, closed surface is produced. A tar-bound surface of this sort does not become slippery under traffic.

#### **Retread**

The retread type of surface has been built for something over ten years. Some of the earlier jobs were built with an open surface and have required somewhat frequent maintenance treatments to keep them in shape. Gradually the original open surface has been filled by the additional surface treatments until comparatively little maintenance has been required.

In an attempt to obtain this result when the retread is first built, experiments have been carried on during the past few years in the use of natural and artificial sand for the purpose of filling the surface voids in retread construction.

A sand-filled retread job starts like the ordinary retread with the spreading of a layer of crushed stone or slag about 2½ in. deep over the existing base. The



*Spreading Tar for Soil Stabilization*

aggregate used ranges from ¼ to 1¼ in. in size. This is coated with approximately ¾ gal. of tar RT-8, mixed in place on the road. The mixture is rolled.

Sand filler is then spread over the surface in sufficient amount to fill the surface voids. This will require from 30 to 40 lbs. per square yard. Sweeping and rolling is continued during the application of the sand. Every effort is used to fill the voids with the sand as thoroughly as possible. Traffic is not permitted over the road during this operation. A second application of tar is made at the rate of 4/10 gal. per square yard and covered with aggregate chips or pea gravel. The covering material is rolled into the fresh tar. The cover is swept to assist in obtaining a uniform distribution of the aggregate. The road may be opened to traffic at this point, and some have gone without the seal coat for several seasons. Usually, however, a seal coat of hot surface treatment tar has been constructed not later than the next year after the original road was built.

Sand of the following grading has been successfully used for building the sand-filled retread:

	Per Cent
Passing $\frac{1}{4}$ -in. square sieve.....	100
Passing No. 10 sieve.....	76
Passing No. 40 sieve.....	18
Passing No. 80 sieve.....	3
Passing No. 200 sieve.....	2

A number of jobs have been under traffic for several years with satisfactory results. The cost of construction is about the same as for ordinary retread, and a tight, rugged surface is produced which requires little maintenance.

### Hot Tar Mix

Much of the early tar work was of the hot mix variety made in a paving plant. Attention was then turned to penetration macadam and road mix types, and the hot tar mix was neglected.

Within the past two years the type has been revived and modified in accordance with modern paving ideas.

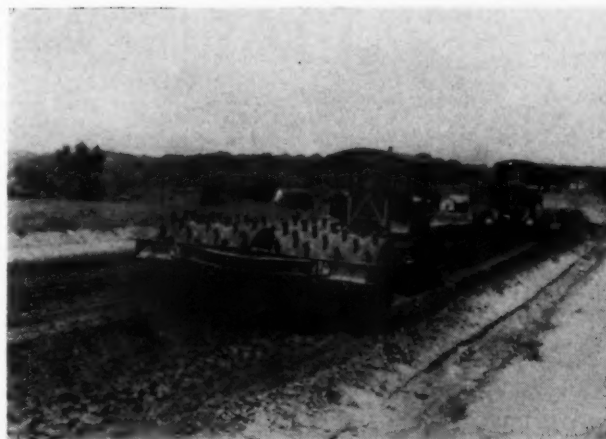


*Spreading Soil Over Tar*

Hot tar mix has been used recently both for foundation and for surface courses. It would seem to possess several advantages for base course work. The mix sets up quickly and thus permits the rapid construction of base courses. Where considerable thickness is required, the mix may be readily laid in two or more courses quickly and efficiently. The tar binder is not affected by water and thus will not be disintegrated by the presence of water in and around the base.

For top courses it permits the construction of a close, tight top without the danger of producing a slippery surface. Tar can be used successfully with aggregate containing an appreciable amount of water so that the paving plant may be operated to its maximum capacity. (Tar readily coats most aggregates so that the mixing time can be reduced to a minimum.) On the other hand, temperature control of the aggregate is very important, and the temperature must not be high enough so that the tar will be distilled on the surface of the aggregate.

For the surface course a grading of aggregate is used



*Consolidation with Sheepfoot Roller*

which will produce a tight surface. A typical grading is as follows, using Tar RT-11 or RT-12 as the binder:

Passing Sieve	Retained on Sieve	—Per Cent—	
		Min.	Max.
$\frac{1}{2}$ -in.	$\frac{3}{8}$ -in.	0	7
$\frac{3}{8}$ -in.	No. 4	25	45
No. 4	No. 6	0	15
No. 6	No. 50	20	45
No. 50	No. 200	3	15
No. 200		0	5
Tar binder		6	8.5
Total retained on No. 6 sieve		50	60

Hot tar mixes are evidently destined to again take an important part in the highway program.

### Soil Stabilization

The work on the use of tar in soil stabilization has continued during the year. Additional projects have been constructed in different parts of the country.

Standard laboratory tests for determining the proper grade and amount of tar for stabilizing a particular soil have not been developed as yet. However, several independent methods are being used, and plans are under way to evaluate the results obtained by the various methods.

Certain trends are indicated by the experience in soil stabilization with tar to date.



*Finished Tar Soil Stabilization Job in Michigan*



*Finished Tar Soil Stabilization Job in Vermont*

The depth of the stabilized layer should not be less than 4 in. The depth is often limited by the efficiency of the soil handling machinery.

Soils containing more than 50 per cent of material passing the No. 200 sieve justify the use of sand or a similar aggregate admixture.

The grade of tar should be as heavy as can be efficiently mixed with the soil.

The amount of tar necessary to stabilize the material passing the No. 10 sieve (the soil mortar) will usually be between  $\frac{1}{3}$  and  $\frac{1}{2}$  gal. per square yard per inch of depth.

The presence of aggregate larger than the No. 10 sieve will reduce the amount of tar in direct proportion to the amount of such aggregate. No additional tar need be allowed for coating the coarse aggregate.

Soil to be stabilized should be pulverized to approximately  $\frac{1}{2}$  in. size. Aggregate particles, of course, may be larger.

Soil and tar will mix best when damp.

The tar-soil mixture should be near the optimum moisture content at the time of consolidation.

A tar prime coat on the sub-grade is a valuable part of the treatment in theory, but in practice it is exceedingly difficult to construct and preserve an unbroken rich layer on the bottom of the stabilized soil.

Although the sheep's-foot roller is not an ideal compacting tool, it is the best available machine for the purpose.

The sheep's-foot roller should be stopped when there is from 1 to 2 in. of loose material remaining and the consolidation finished with a truck wheel or other similar roller.

The soil should be worked with a blade or drag during the operation of the sheep's-foot roller.

The tar tack coat should be applied to the surface as soon as the consolidation is finished.

The tar-stabilized soil foundation must be protected with a traffic-resisting and weather-resisting seal coat or wearing course.

Tar-soil stabilization produces a relative improvement in the supporting power of the soil which may not be sufficient to resist the forces coming upon it where the layer is thin and the sub-grade is bad. Some movement may occur under these circumstances, but the sections are generally small and easy to fix. The usual

method is to scarify to a greater depth, add some more tar, and re-mix.

### Conclusion

The use of road tars has advanced in 1938 in the high type field by the introduction of the hot tar mix and in the low cost field by the development of the improved sand-filled retread.

In the new field of soil stabilization, tars have been used extensively, and the necessary construction operations have been practically standardized.

### SERVICING TRAFFIC SIGNAL LIGHTS

The County Road Commissioners of Wayne County, Michigan, operate stop and go signals at 193 road intersections and flashing signals at 102 intersections in the county. Of these signals, 110 are on heavy traffic roads within the limits of Detroit, but near the outskirts of the city.

There are 3560 light bulbs burning in these signals day and night. Since electric light bulbs burn out after a number of hours use, it is necessary to provide for their replacement. The bulbs used are a special design made for traffic signals and have a guaranteed burning life of 3000 hours, that is, about 4 months.

The motoring public has become so accustomed to rely upon traffic signals that they are endangered if one becomes inoperative. The burn-out of a light bulb is likely to cause an accident, or the failure of the timing device will cause confusion.

There are a number of methods in use for servicing traffic signal lights in order to keep them lighted and operating at all times. The maintenance method used by Wayne County Road Commissioners calls for a card indexed program of light-bulb changes based upon the length of time the bulb burns. For example, only one-half of the number of lights in a signal are burning at one time. If the length of green light period allotted to each of two roads is the same, then all of the red and green lights are burning for one-half of the time. If the signal operates for 24 hours of each day, a 3000-hour bulb in the red or green face should endure for 6000 hours, or about 8 months.

It is readily understood that where the division of time allotted to each road is uneven, the red, green and amber bulbs will remain in service for different lengths of time. Therefore, 3 indexed cards are maintained for each signalized road intersection.

These indexed cards are so rotated in the file that the bulb changes due each day appear on the front cards. Each day the foreman assigns a number of changes for the attention of the signal maintenance crew of 2 electricians with a light truck.

While all bulbs have varying amounts of life left at the time of the change, it has been found dangerous to leave them in service longer.

At first glance this method may seem expensive because of the extra light bulbs used, but the Wayne County experience indicates it is not. If the light bulbs are permitted to burn their full life, it would be necessary to employ a day and night crew of patrolmen in order to keep these signals burning and avoid accidents. Under the present method a crew of 2 men working for 8 hours a day and 5 days a week can service all lights and keep the timing devices in good repair.

During 1937 only 33 burned-out bulbs were reported out of the 3560 in service.



# TRENDS IN ASPHALT CONSTRUCTION

## *A Review of Some Developments In Its Use During the Past Year*

By D. D. WILLIAMSON

*District Engineer  
The Asphalt Institute*

THE HISTORY of road building in the United States has been from the beginning, and to a certain extent still is, a problem of building transportation lanes through practically virgin country with current income. Occasionally various states have had through large bond issues what was at first considered large amounts of money, but after this money was applied to connect the commercial centers little money remained to develop the real wealth of the country—the farms and villages of America. We have, of late, had quite a bit of conversation concerning the Constitution but we may say with certainty that no group of Americans has said as little and done as much to “Form a more perfect Union” than that group entrusted with the building of roads connecting these States.

Old methods are not necessarily bad simply because of age—new methods are not perfect because they are new. The engineer is forever combing out the proven good of the old to combine it in durable construction. This is,

in fact, the new. Since available money has been insufficient, the engineer through his skill in the proper use of local material has been able to more nearly balance the race between miles of sound durable construction against the demands of modern traffic. It has never been our plan, either by Government or desire, to produce mileage by concentration camp labor or semi-slavery but rather to build through brains.

For the past 20 years it may be that our thoughts have been too much on the building of roads to accommodate traffic, with too little stress on the safety of these roads. During the last few years, however, and more so during the past year, the engineers have had foremost in their minds the building of safety into the highways. A definite trend during the past year is, therefore, along the lines of the use of asphalt construction in its many different phases to modernize old roads and to develop new ideas of safety. Under this head may be included road widening, resurfacing, safer shoulders, and, of great



*Modern Mississippi Highway Near Hattiesburg Constructed of Black Base and Asphaltic Concrete Surface Course*

importance, the trend toward the construction of asphalt sidewalks for the almost forgotten pedestrian.

### Sidewalks

In rural areas approximately one-third of all deaths in which motor cars are involved are pedestrians. Although we have spent considerable money on grade crossing elimination, death has struck down twice as many pedestrians as have been killed in grade crossing accidents. The National Park Service naturally has developed sidewalks to a greater extent than other units. Massachusetts has pioneered this work among the states and at the present time we find considerable work along this line under construction in the states in the Middle West and the Pacific Coast. The choice of asphalt sidewalks depends on the funds available and on the type of local material available. Asphalt stabilized earth, sand mix, surface treated penetration macadam, and cold and hot asphaltic material are being used. Massachusetts requires a broken stone base or gravel foundation with a 2-in. asphalt plant-mix top. We may expect an even greater trend toward pedestrian safety in 1939; the need is great, the cost of construction is low. Unemployed labor may be used in this type of construction to particular advantage. Obviously there is only one way to reduce or to eliminate pedestrian accidents and that is to keep the pedestrian off the highway.

### Safer Shoulders

Without doubt nothing has so focused attention upon the unsightly and unsafe condition of pavement shoulders as the very good work being done in highway beautification. In arid areas, without vegetation to tie down the shoulder material, it is impossible to keep the shoulder level with the pavement. Fast moving trucks and cars have a tendency to suck up base material which is then blown away. States not bothered by dryness are troubled by water erosion at the pavement edge. A very great hazard both mental and actual is presented by dangerous shoulders. If the shoulder is lower than the pavement or in bad condition due to water erosion and ruts, the available traffic lane of a 20-ft. road is cut down (for all practical purposes) to about 16 ft. since the driver unconsciously avoids the dangerous shoulder.

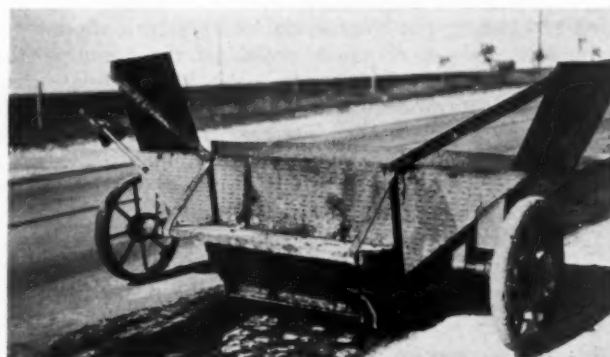
Shoulder work must not be confused with highway widening. In the development of better shoulders highway departments are making efforts to invite the traffic to the edge of the road but not to widen the road sufficiently to provide an additional lane. The State of Texas during the past year has constructed approximately 500 miles of asphalt shoulders. These shoulders for the most part are from 18 in. to 30 in. in width. In this construction various methods have been used depending upon the local material available. Where it appears that eventually the road will have to be widened and resurfaced, the program has been one of providing approximately 5 ft. gravel shoulders with 18 in. to 24 in. surfaced along the pavement edge. This provides a transition from the pavement to the asphalt shoulder to the gravel. Where further widening is not deemed necessary 3 ft. gravel shoulders are placed with 18 in.-24 in. being surfaced. Work of this type costs from \$2,000 to \$5,000 per mile. The soil itself in a number of cases has been stabilized by the use of emulsion or cutback asphalt which is sealed later with an asphalt penetration top. Much work has been accomplished on the development of stabilized shoulders using "mud shell" along the coastal areas of Texas and the stabilization of caliche in the West Texas area. "Mud shell" and "caliche" cover a rather wide field—"mud shell" in the strength of the shell and quality of fine material with caliche ranging from a fine, powdery

material to a type of caliche gravel. The experimental work, therefore, has been along the lines of developing the proper cutback asphalt or emulsion best suitable to the particular material. Very good results have been secured with emulsions and RC cutbacks.

In addition to the safety angle, the building of adequate shoulders is considered of utmost importance in the prevention of high joints in portland cement concrete pavements due to extreme moisture change in the base.

### Shoulder Widening and Resurfacing

As stated above, widening presents a different problem than shoulder conditioning and may be tied in with resurfacing. Reconditioning and modernizing continue to be the trend. In some states we have already reached the point where the resurfacing or modernizing of old roads is of greater importance than the construction of new roads. Engineers now realize that many highways constructed 10, 15, or 20 years ago are due for complete modernizing. Most of the old roads can be brought up to date by widening and resurfacing. It is now realized that in order to protect the original investment these roads can be reconditioned economically only by resurfacing before deterioration has advanced too far. Many



*Texas State Highway Spreader Box Designed for Asphalt Shoulder Construction*

highway departments are using some type of asphaltic concrete for widening with an asphaltic concrete top extending across the entire pavement.

While most of the salvage operations in Ohio have consisted chiefly of plant produced asphaltic mixtures, considerable road-mix work, however, is being used. An asphaltic mixture 1½ in. thick was placed and 15 lb. of chips were used with an appropriate quantity of asphalt for seal coating. A light tack coat of emulsified asphalt was first placed on the old concrete or other surface to be salvaged. This was followed by coarse aggregate and then liquid asphalt RC-3 was applied at the rate of 1.1 gal. per square yard. Approximately 10 per cent of fine aggregate was then placed to assure correct grading with minimum segregation. The road-mixer then followed, coating, mixing, and spreading the aggregate. It was then rolled. Sufficient time elapsed before sealing to permit the asphalt to thoroughly aerate. After aeration was completed, similar asphalt material was then placed as a seal at the rate of 0.2 gal. per square yard. A cover coat of fine crushed aggregate was then used at the rate of 15 lb. per square yard.

New machinery has been developed for this work of shoulders and highway widening. The advantages of these widening machines include the clean-cut manner in which widened areas are excavated, some of these machines digging trenches as much as 48 in. in width. It has also been necessary to develop new type trench





*Asphaltic Concrete Sidewalks in Massachusetts*

rollers which develop compressive weights of approximately 320 lb. per inch of width and adequately answer the question as to securing proper compression in narrow sections.

In the Southwestern States we find that resurfacing has been carried on to a very great extent through the use of cold-laid asphaltic concrete. This material is produced at stone quarries in accordance with Highway Department Specifications. For the most part the asphalt used is of the RC type.

Mississippi has recently completed on U. S. 51 a resurfacing project over an old brick pavement. The resurfacing mixture was composed of local sand and slag with 120 penetration asphalt and in some cases curves were super-elevated by as much as 12 in.

Montana and the states in this Rocky Mountain area have done some very good work during this past year on eliminating bad curves through widening and elevating.

New Jersey is using a low cost resurfacing with cold laid asphaltic concrete at a cost of less than \$0.50 per square yard, consisting of approximately 125 lb. per square yard.

The New England States have been very resourceful in modernizing their old type roads. Gravel sub-base is used on each side and extended 3 ft. to 4 ft. beyond the old surface to form the shoulders. After widening operations are completed a tack coat of RC-1 is applied which is followed by a 1-in. road-mix surface course consisting of pea gravel and RC-1.

Salvaging roads built 10 to 15 years ago has long been routine activity in the Pacific Coast States. California in particular continues with both asphaltic concrete surface and leveling-up courses. The relatively low cost of this high type asphaltic material is due to the large tonnage involved and, of course, to the fact that California is ideally situated regarding local aggregates. At the present time we note increasing realization from the engineers that the price of asphaltic concrete perhaps more than any other product is in direct ratio to the tonnage involved.

In many Southern states construction has been to a great extent along the lines of road-mix. Until quite recently plant-mixed asphaltic concretes have been more expensive than equal quantities of road mixes. In many localities, however, we now find that plant-mixed asphaltic concretes, more especially of the cold-laid type, are rapidly approaching the cost of road-mix. Undoubtedly better control can be exercised where plant-mix is used. Alabama has used cold-laid asphaltic concretes quite extensively during the past year which are outstanding in their non-skid qualities. The first course contains aggregate with a maximum size of 1 1/4 in. with the second course consisting of limestone or slag consisting of from 3/4 in. down to fines. Here we find again the use of a rapid curing liquid asphalt—RC-4.

## Economics

Following close upon the heels of building for safety we find the very urgent desire for economy. Soil stabilization has advanced considerably during the past year. States are still building experimental test sections in very worthwhile efforts to see just what can be done. For the purpose of better understanding we might divide soil stabilization into two parts. First, true soil stabilization and second, waterproofing of the soil. Highway engineers through actual construction realize that true soil stabilization, wherein our knowledge of soil mechanics is combined with our knowledge of asphalt mixtures, has been developed so that a designed mixture will give adequate and desired results.

True soil stabilization means not what the name appears to imply but rather the combination of the soil in place with more favorable aggregates or other soils so that a reduction in the quantity of asphalt may be the result. A definite trend has been noted during the past year toward the use of quarry waste for base stabilization. During the past 20 years various quarries and gravel pits have developed enormous stock piles of material unused for other highway work. During the past year we find that cities, counties, and states have taken advantage of the trend toward stabilization through incorporating these once useless materials into the road soil to form an ideal and economical foundation.

Florida, Nebraska, and several of the Middle Western States have used a type of soil stabilization in their sandy soils for a number of years. This type continued popular throughout 1938. In Oklahoma, Texas, Missouri, Kentucky, Ohio, and several other states intensive research projects on soil stabilization have been carried on. These research projects for the most part are along the lines of treating clay type soils with asphalt as waterproofing and stabilizing materials.

Various engineers throughout the United States report that soil stabilization is one answer to the problem of highway economics and feel that very definite progress has been made during the last year along the lines of increased knowledge toward stabilizing road soils alone with various types of asphalt. Due to research work conducted by several states in 1931 to determine the cause of warped joints we now find a number of states using a waterproofing type of stabilization as base for concrete slab.

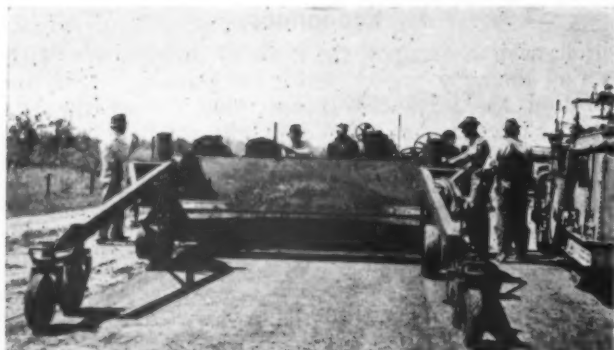
## Cities

While the statistics are not available we have daily been brought face to face with the great strides made during 1938 in city construction. Primarily, this has been due to the work of the WPA and PWA. In the larger cities we have noted much track removal neces-



*Asphaltic Concrete Revetment with Wire Reinforcing to Prevent Undercutting, Big Tujunga Wash, Los Angeles*





Front View of Adnum Black Top Paver Showing Special Jagoe Knee Action Attachment

sitating new base and to a great extent resurfacing of the entire pavement. With the elimination of the tracks cities are no longer confronted with the pounding action of the street cars. In many of the cities some type of asphaltic concrete has been used to replace the tracks and at the same time new asphalt pavement has been built from curb to curb.

Chicago reports that for the year up to October 20, 1938, 1,876,512 yd. of asphaltic material had been laid. In the residential sections of the larger cities asphalt stabilized base has been used extensively with various types of top. Due to the constantly lowering price of asphaltic concrete suburban areas and new residential districts have used this material to an increasing extent.

### Cotton Roads

A word might be said here concerning the development of the so-called "cotton road." This type, initiated by the Bureau of Public Roads, is now entering its twelfth year. In more than 20 states we now have a total of 500 miles of bituminous roads reinforced with cotton fabric. While these tests still have considerable time to run before engineers will call them conclusive, they are being closely watched by State Highway Departments and by those interested in the development in the new uses of cotton. For the most part these cotton roads are constructed by placing the cotton fabric upon the primed base. After impregnating this fabric with a coat of asphalt a surface coating of gravel, crushed stone, or slag is applied and rolled. If it is finally determined that the expenditure is justified, this type of road will furnish a considerable outlet for surplus cotton since a mile of this type uses the equivalent of 8-10 bales of cotton.

### Road Building in the South

While the South has of late been publicized as "America's Number One Economic Problem," we find road construction remedying at least some of the major causes by connecting the important farm sections to markets. Considerable progress has been made in the Southern States during the past year due to the very intelligent studies of local aggregate to be used in base construction and asphalt surfaces.

The States of Mississippi and Alabama have made extensive investigations of the location of various types of asphalt aggregate. Where sand is available a popular type of hot-mix sand asphalt has been used with loess as a filler. Hot-mix asphaltic concrete has been used during the past year very successfully in Mississippi. The State of Alabama appears to lean toward the use of penetration surfaces and plant-mixed asphaltic concrete. Particular stress has been laid on the riding qualities of the asphalt roads in these two states.

### Construction

We have touched lightly upon construction methods. Applied research has continued its good work. True soil stabilization is being extensively used with increasing popularity. Much more attention has been given to base construction during the past year with the surface constructed through intelligent use of local aggregate. In the preparation of base and in the salvaging of old roads where widening is carried out the trend is toward the use of French drains constructed at intervals and extending from the edge of the old pavement under and beyond the added width. As a rule these drains consist of loose stone 10 in. x 8 in. with the upper portions of the drains impregnated with asphalt to prevent the structure from becoming clogged with fine dirt from above. Water finds its way into the drains from the sides rather than from the surface.

More judicious use of the tack coat in resurfacing is noted. It has been found that too much tack coat, especially on portland cement concrete, finds its way through the asphaltic mix used in resurfacing. Surface treatments continue to be popular in many states especially where emphasis is placed upon good base. However, a trend is noted toward the use of cold plant-mix asphaltic concrete due, of course, to better control and the constantly lowering price trend in recent years.

Cutbacks of high viscosity continue to be preferred. A much better understanding of the various types of cutback asphalts may be noted during the year 1938. Engineers have realized that not only temperature, but to an even greater degree humidity, are the controlling factors in their choice of cutbacks. It is difficult to define any one particular trend in the use of cutbacks. It appears to be simply that due to better knowledge of cutbacks, the proper cutback is chosen dependent upon the general climate of a particular section and also dependent upon the time of year the cutback is to be used. Possibly one way of saying it would be, the use of highest viscosity consistent with manipulative control.

The trend during the past year in the United States has been definitely toward the use of softer asphalts. Engineers are becoming conscious of the fact that the consistency of asphalt binders as represented by penetration tests have relatively little relationship to stability of pavements in which they are used. Factors of design other than the penetration of asphalt, principally ratio of asphalt and aggregate, govern more importantly in developing necessary stability. In the construction of airport surfaces we find this trend even more pronounced, naturally because of the little amount of traffic, and the need for resistance to weathering.

Certain states along the East coast, namely the Carolinas and Florida, present a fairly strong trend toward mixed-in-place construction. We find this trend more pronounced wherever sandy areas predominate. Due to the very extensive work in asphalt construction of airport runways stress has been placed upon the choice of light-colored aggregate for seal coats, to insure high visibility.

Road construction machinery in 1938 developed principally along the lines of additional capacities, thereby tending to lower costs of soil stabilization, road-mix, and plant-mix material.

A development somewhat out of the ordinary in machine spreading was brought about in Texas. In November, 1937, a contract was let for the surfacing of a Portland Cement grout bound macadam base on State Highway No. 89, Parker County, Texas. Rough-o-meter tests taken on this base indicated a coefficient of 140 per

mile at 60 miles per hour. After inspecting this base, Mr. W. W. Jagoe decided that some machine other than those in use would be necessary to secure a smooth riding surface on the completed asphalt pavement; therefore, he designed, patented, and constructed a knee action hydraulic arrangement for his Adnun black top paver. This mechanical device works on the same principle and is very similar to the knee action front wheels on an automobile. A photograph of this new development is shown. Tests taken after the completion of the asphalt surface with the same rough-o-meter, attached to the same automobile and at the same speed, showed a coefficient of 25 or 26 per mile while on several miles of this surface the coefficient was less than 20. It is the opinion of the engineers in charge that most of the credit for such a remarkable increase in smoothness should be credited to this knee action attachment.

Engineers have been faced in practically every area of the United States with terrific destruction of highways due to floods. The Mississippi revetment work has developed keen interest in the construction of asphaltic mats where erosion has taken toll in the past. Attention is called to photograph showing typical revetment work in California.

### Summary

1. Emphasis has been placed on safety. Curves have been widened and rebuilt with asphalt. Accidents due to faulty shoulders are being eliminated by better shoulder construction.
2. The use of asphalt to salvage old pavement is definitely on the increase. Old pavement is being modernized by widening and resurfacing with various types of asphalt.
3. The trend is toward the use of softer asphalt cements.
4. New mixing equipment is further developing the use of higher viscosity liquid products.
5. Through research and experimental work a better knowledge of the benefits of asphalt stabilization is opening a new field of economical design.
6. The advancement during 1938 of asphaltic revetment construction and airport runways is notable.

## THIRD PAN-AMERICAN HIGHWAY CONFERENCE

The United States Government has accepted an invitation from the Government of Chile to participate in the Third Pan-American Highway Conference, which convened at Santiago on January 13, 1939. Previous conferences in this series, held at Buenos Aires and at Rio de Janeiro in 1925 and 1929, respectively, have been instrumental in disseminating technical information concerning highway construction in the American Republics and have stimulated interest in the early completion of the Inter-American Highway. The agenda of the forthcoming Conference indicates that the Santiago meeting will have the same objectives.

The President has approved the following persons as members of the United States delegation to this Conference:

### Delegates

The Honorable Norman Armour, American Ambassador to Chile, *Chairman of the Delegation*;

Mr. Edwin W. James, Chief, Division of Highway Transport, Bureau of Public Roads, Department of Agriculture;

Mr. John Van Ness Philip, United States Member, Pan-American Highway Finance Committee, Claverack, New York;

Mr. R. H. Baldock, State Highway Engineer, State Highway Commission, Salem, Oregon;

Mr. B. M. Duncan, General Manager, Overseas Highway Improvement District, Key West, Florida;

Mr. John Abbink, President and General Manager, Business Publishers' International Corporation, and Member, Executive Board, Foreign Trade Council, New York, New York.

### Technical Advisers

Dr. William R. Manning, Department of State;

Mr. Barton P. Root, Chief, Highway Section, Automotive Aeronautics Trade Division, Bureau of Foreign and Domestic Commerce, Department of Commerce;

Mr. George Bauer, Manager, Export Division, Automobile Manufacturers' Association, New York, New York;

Mr. Stephen James, Director, Highway Education Board, Washington, D. C.

### Secretary of Delegation

Mr. Cecil B. Lyon, Third Secretary, American Embassy.

## MAINTENANCE AS SHE IS DID (IN SOME PLACES)

The editor can not resist publishing the following extract from a letter from a California farmer friend. Aside from this paragraph, the letter was strictly personal and carried no reference to public work, politics, business or economics. Fortunately, we know the picture is not typical of the State. Unfortunately, we know it can be duplicated in hundreds of places throughout the country.

"You would be disgusted if you could see the county resurface the road in front of our place. They did 1½ miles one day, ¼ mile an afternoon two weeks later, and the last 200 yards to the corner has already waited several days since that ¼ mile, which ended by our driveway. They had 8 or 10 gravel trucks standing in a line on the side of the road, also the hot asphalt truck and a couple of pick-ups. There were two men with red flags, and several men on foot. After looking it over awhile, a thin coat of pea gravel was sprinkled on, a man going on foot behind each truck to regulate the spreaders. The empties drove off, and all of the men stood in the road and talked while a pick-up dragged a strip of wire netting over the road to settle the gravel evenly, and while the hot asphalt was put on. There were 10 men standing in one group, and some single men besides. Finally, the remaining gravel trucks were backed over the oiled surface, a man on foot by each to regulate the spreader; in this way the trucks rolled on their own gravel and did not get into the asphalt. Half the trucks and one-third of the men would have done the job if a contractor was handling it."

**SPECIAL MOTOR HIGHWAYS IN GERMANY**—At the end of September 1,422 miles of the national automotive highway system were in service. At the same date 1,199 miles were under construction. An average of 25,825 men were employed in this work during September.

**COLORADO HIGHWAY CONFERENCE**—The 13th annual highway engineering conference at the University of Colorado, Boulder, Colo., will be held Jan. 19-20. C. L. Eckel, Head of the Department of Civil Engineering, is in charge of the conference.



# OBSERVATIONS

## BY THE WAY

By  
**A. PUDDLE JUMPER**



At the Dallas convention of the American Association of State Highway Officials last month, Texas did a job in keeping with the width, breadth, and traditions of the state. Over 600 were registered; which resulted in a bang-up meeting. I missed Lacey Murrow of Washington, B. G. Dwyer of New Mexico, Fred Panhorst and his gang from California, and many others. There were friends there whom I saw at a distance only occasionally, the attendance was so large. Congratulations, you long-horned, superbly hospitable Texans.

On most any floor of the hotels where the A. A. S. H. O. conventioners were assembled one could detect, by close observation, what were supposed to be the strains of "Sweet Adeline." It became the lot of the Singing Mayor of Texas (Hissoner Shepherd of Wichita Falls) to crystallize those three-day attempts, in a riotous volume the night of the banquet. Apparently, Adeline knew what was coming and energized those lusty throats with her spirited presence.

Speaking about the banquet constrains me to remark that Congressman Wilbur Cartwright (Oklahoma, Texas, and points West) is the best after-dinner speaker I ever heard. He started thus:

"There are thorns on all the roses,  
There's fuzz on all the peaches,  
And when there's 'ere a banquet,  
There's bound to be some speeches."

For the next five or ten minutes, with a perfectly dead-pan expression, he kept the crowd roaring. He says banquets give him "curvature of the vest."

December is apparently the season for grass and brush fires in Oklahoma. One day I counted 12 big fires as I drove through the state.

I don't want to be a secretary; I'd rather be a cowhand. Wonder if Miss Fuller, ruler of roost at T. H. MacDonald's office, intends to rope one of those cars or is she just having a good time? What a foolish question.



Wasn't I there? That gal was having the time of her life. She roped so many men with her fetching smile that she should have been provided with a sword to beat them off instead of with a lariat.

At the soil stabilization sessions of the Highway Research Board meeting in Washington, I noted a commendable procedure. Chairmen of the group meetings were selected in honor of the contributions they have made to soil science. There's one case where a man did not have to die before gaining recognition for his work. Let's have more of it.

Conventionites and banqueters are usually in a facetious state of mind, so Frank Balfour, Right of Way agent for the California Highway Department discovered. At the Washo dinner the evening previous to the big blowout, the word was quietly passed around that when C. D. Vail, State Highway Engineer of Colorado and president of Washo, called upon Frank, all present would give him the Elks' cheer; it runs as follows to the characteristic tune:

"He wants to make a speech,  
He wants to make a speech,  
Heigh Ho, the merrio,  
He wants to make a speech."

Not to be outdone by the clamorous noise set up, Frank was able to squeeze in a few words to the effect that he came from Los Angeles and had been insulted by experts. It was a merry time for a while; Frank never got the speech out.

On the way from Washington, D. C., to the Dallas A. A. S. H. O. convention, I saw a good idea at work, which was made possible by good roads. It was a Community Sale at Vinita, Oklahoma. Farmers from near and far were bringing by truck, car, and wagon, things they would sell or barter to get something they wanted. The town took on the aspect of a Saturday afternoon crowd.

At the session of the Bridges and Structures Committee of the A. A. S. H. O., I was struck by the enormous persistence required of the committee chairman to get those state highway bridge engineers to discuss a paper. Their conservatism has got them there, too.

Just outside of Beaumont, Texas, on U. S. 69 and 59 is an underpass believed to be the lowest in the country. The road surface is 4 ft. below sea level.



¶ They tell a story on Little Ike Ashburn (325 lb.  $\pm$ ) of Texas that can bear repetition. It appears there's a scale in Texas that shouts out your weight when you drop a penny in the



slot. Little Ike stepped on the platform one day, dropped a penny in the slot, and the scale shouted, "One at a time, please."

• •

¶ Herewith a picture of Miss Leah Moncure, graduate civil engineer, a member of the American Society of Civil Engineers, a licensed practicing engineer in Texas, who works in the Division office of the Texas State Highway Department at Beaumont,



Texas. I wonder how many more of the feminine gender there are in highway work, with these qualifications? Send your entries to A. P. J., with picture.

• •

¶ Congratulations, Ohio, not on your political mess, but for those reflectorized safe speed signs you have placed on the curve signs on U. S. 40. I hope you continue the good work. They're also good on U. S. 36 in Illinois.

# STATE OF NORTH CAROLINA STATE HIGHWAY AND PUBLIC WORKS COMMISSION: RALEIGH, N. C.

"A. Puddle Jumper,"  
Care Roads and Streets,  
330 S. Wells Street,  
Chicago, Ill.  
Dear Sir:

You have completely disrupted the office of our Bridge Department with your problem on the cow and the train. Designers, draftsmen and all insist that there is something wrong with your statement of the problem. However, I am enclosing a solution which makes the bridge only three inches long.

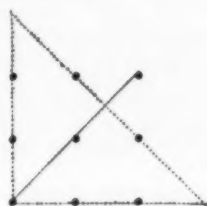
If you can end the discussion with a correct solution, please send it along so that the New Year can be started off right.

Yours very truly,

B. H. CONNER,  
Office Engineer.

The correct answer is 43 feet (to nearest whole foot.) The problem was published in the December issue.

¶ Herewith is the answer to the puzzle about the dots. These two



puzzles were taken from the *Montana Center Line*.

• •

¶ Hold 'em, cowboy. Tom MacDonald, chief, U. S. Bureau of Public Roads, looked over the wide open



spaces of King Ranch, Texas. Hang on, Mac, that horse sees a maverick.

• •

¶ Of all the states, for night driving I prefer Texas.

¶ When M. H. Hodges, maintenance engineer for Texas, slipped up with his camera, he caught Burr Simpson (right), Commissioner of Highways, West Virginia, explaining



to Vic Brown, publishing director of *Roads and Streets*, why a road to Alaska would cost at least \$65,000 per mile to build. He knows.

• •

¶ If you want to travel an obsolete road some day when your out of your mind, get on the west end of U. S. 50 in West Virginia. How much more than 40 miles of it is there, Mr. Simpson?

• •

¶ Taking a dig at a state, like the remark above about U. S. 50, is not quite fair. After all, the railroad and canal interests of West Virginia have appropriated just about all of the good locations. However, A. P. J. believes the ingenuity and forbearance of Mr. Simpson and his staff will suitably surmount these difficulties.

• •

¶ Why state highway department bridge engineers are so reluctant to employ soil science in their design procedure is difficult for some engineers to understand. An opinion expressed indicates that there is a point of economy involved. Maybe—and again—maybe.

• •

¶ I don't know why I continually get into the hair of these bridge engineers. Perhaps the following actual introduction may be a partial explanation:

"Mr. —, meet Mr. Jemison, our bridge engineer," spoke Commissioner Simpson of West Virginia. "He designs our bridges for standard loadings and then doubles it."

Believe me, West Virginia's bridges look it, too. I believe they would carry a couple of mountain locomotives. Nicht war, L. L.?

# INTERESTING AUTOMOTIVE DATE

1892—William Morris of Des Moines, Iowa, built an electric automobile and sold it to J. B. McDonald, president of the American Battery Co.

# American Road

WASHINGTON, D. C.

## WESTERN HIGHWAY OFFICIALS TO

# Down the Road

By CHARLES M. UPHAM

*Engineer-Director,  
American Road Builders' Association, Washington, D. C.*

## WESTERN HIGHWAY OFFICIALS TO MEET WITH ARBA CONVENTION

The most important highway event ever staged for a Western public will be the 36th annual Convention and Highway Exhibit of the American Road Builders' Association in San Francisco's Civic Auditorium, March 7-10, 1939. Associations meeting concurrently with the ARBA Convention and Highway Exhibit are the Associated General Contractors of America, the Western Association of State Highway Officials, the California County Supervisors' Association and the Associated Equipment Distributors. Special trains and planes will bring state, city and county officials, safety experts, manufacturers and their distributors, highway planners, contractors, educators and legislators from all parts of the country to the first ARBA conclave on the West Coast. The demand for exhibit space far exceeds all early expectations as applications continue to pour into the ARBA Washington offices. While San Francisco's excellent hotel facilities mean that there will be no housing troubles at the 1939 conclave, delegates who desire choice locations within walking distance of the Civic Auditorium and other points of interest will do well to make their reservations early. Hotel reservations should be sent to the ARBA Housing Committee, Exposition Auditorium, Civic Center, San Francisco. Special train and plane rates to San Francisco will be in effect.

## NATIONAL PAVING BRICK SETS CONVENTION DATES

The National Paving Brick Association will hold its 33rd annual meeting at Columbus, Ohio, February 1-3. The program will include papers by prominent engineers and contractors and many of the sessions will be open to the general public.

M. J. Hoffmann, chief bridge engineer in the Minnesota Highway department since 1925, has been named Commissioner of Highways by Governor Harold E. Stassen. Commissioner Hoffmann succeeds N. W. Elsberg, who resigned office Jan. 3 after being state highway commissioner since 1932. Commissioner Hoffmann, who is 49, is a veteran in the Highway department, having joined it in 1914. With the exception of a two-year absence while in the service during the World War, he has continued with the department.

## HIGHWAYS OF TOMORROW

A new year, a new prosperity, a new Congress and a promise of legislation for new and safer highways.

Those who forecast with care and the most usual accuracy predict for 1939 a boom for all kinds of business. Capital will emerge from long hiding in the dark recesses of "fear of expansion." Industry is going to hire more men. The number of unemployed will decline. The average pay check will be bigger. Store sales will reach a new high. More homes will be built than in any other year during the past decade. More kitchens will be equipped with electrical refrigeration. Air-conditioning units will become as commonplace as the electric fan. Rural electrification will be extended. More homes will know the enjoyment of radio, with television practically a certainty. More families will own automobiles. More, better and safer highways will be built to sufficiently serve this increased motor-vehicle traffic.

The highways of tomorrow are already on the drafting tables of America's highway engineers. The roads of the future being planned by America's road builders include safety features that will make them as near accident-proof as is humanly possible. The highways of tomorrow are also in the minds of public-spirited Congressmen and Senators returning to Washington for the opening of the 76th Congress. These lawmakers are determined to serve all the people. They achieved office through the faith of the people in that promise.

Like convincing an actress that she has grown too old for girlish roles, it has taken a long time to make the public realize that many of America's roads are obsolete and unsafe. Now the public is demanding a system of better and safer roads. The public has

indicated the seriousness and forcefulness of its demand by the passage of a constitutional amendment in seven states outlawing for all time the practice of diverting or misappropriating highway-user tax funds to non-highway purposes.

It is only natural, therefore, to assume that legislation will be introduced in the new Congress that will provide for the construction of super-roads in those sections and between certain metropolitan areas where traffic congestion and too numerous accidents demand particular attention.

Tomorrow's highways will be free-ways. Multiple-lane highways will be constructed with center parkways to separate opposing streams of traffic. Highway illumination will be provided for the most heavily travelled arteries. Steep grades will be levelled and sharp curves will be straightened. Grade crossings and blind intersections will be eliminated. Guard-rail protection and pedestrian walkways will be provided where urgently needed and all surfaces will be skidproofed. Highway-traffic accidents, which took 40,000 lives in 1937, will be reduced at least fifty per cent when this modern super-program is put into effect. These super-highways of tomorrow will be built as component parts of a master plan so that in the future it will be possible to incorporate them into a nationwide system.

Nineteen and thirty-nine will be a year of progress. Its accomplishments will provide added comfort and convenience for America's 130,000,000 citizens. One of its most important achievements will be the beginning of a complete system of better roads over which America's 30,000,000 highway users will be able to travel with added certainty and safety.



# Builders' Review

DECEMBER, 1938

A.R.B.A.

1939 Convention-Highway Exhibit

March 7, 8, 9 and 10

Civic Auditorium

San Francisco, California

## MEET WITH A. R. B. A. CONVENTION

### With Our State Groups

#### COLORADO

The Colorado Association of Highway Contractors will hold its annual convention at the Shirley-Savoy hotel in Denver on January 28. During the morning session annual reports will be made by the officers and will be discussed in open forum. Activities for the coming year will be planned. The annual election of officers will take place at the afternoon session and public officials, including the state highway engineer, will address the group. More than 800 persons are expected to attend the banquet in the evening. Of particular interest to Colorado road builders also is the 13th Annual Highway Engineering Conference, which will be held at the University of Colorado in Boulder, January 19-20. This conference will be devoted principally to research topics and speakers prominent in many engineering fields will present papers. On January 21 the Colorado Society of Engineers will hold its annual convention and banquet in Denver. Officers for 1939 will be elected at this meeting.

#### PENNSYLVANIA

Leading road builders of Pennsylvania and other states took part in the three-day convention of the Associated Pennsylvania Constructors in Harrisburg, December 14-16. Contracts were let by the Pennsylvania Turnpike Commission on December 15 and Walter A. Jones, commission chairman, and Samuel W. Marshall, chief engineer of the commission and the state highway department, were speakers at the luncheon which followed this letting. Charles M. Upham, engineer-director; William C. Slee, assistant engineer-director, and Paul B. Reinhold, first vice-president, American Road Builders' Association, spoke at the general meeting in the afternoon. Short remarks were made by Herbert R. Anderson, president, Illinois Road Builders' Association; George R. Dempster, engineer-manager, Tennessee Road Builders' Association; Floyd E. Koontz, secretary, Michigan Road Builders' Association;



Roger Van Vechten, Wauwatosa, Wis., was re-elected president of the Associated Wisconsin Contractors at the group's annual convention in Milwaukee, December 12-13. Other officers chosen to succeed themselves include L. G. Arnold of Eau Claire, vice-president; N. M. Isabella of Madison, secretary, and A. J. Koch of Whitefish Bay, treasurer. Robert Hinman of Glenwood City and Theodore Bartel of Milwaukee were elected directors. Speakers at the two-day meeting included Julius P. Heil, Wisconsin governor-elect; Thomas F. Davlin, chairman of the state highway commission; ARBA Engineer-Director Charles M. Upham and W. C. Slee, assistant engineer-director of the ARBA. Pictured above are the 1,000 contractors who attended the banquet at the Plankinton hotel which concluded the convention.

W. J. Stiteler, Jr., vice-president, Coal Operators' Casualty Co., and S. S. Riddle, Pennsylvania State Chamber of Commerce. Banquet speakers included ARBA President and Michigan State Highway Commissioner Murray D. Van Wagoner and Harry E. Trout, member of the Pennsylvania House of Representatives. United States Senator James J. Davis of Pennsylvania was unable to attend, but sent his greetings to the group. James J. Skelly, APC president, delivered the address of welcome and A. Earl O'Brien, executive secretary of the APC, served as chairman. A floor show, consisting of stage and radio stars, ended the banquet.

#### NEW ENGLAND

The New England Road Builders' Association held its annual dinner-meeting at the Hotel Statler in Boston on December 12. This dinner, which is the major meeting of the highway year in New England, was attended by nearly 1,500 road builders.

Among the bills introduced in the first week of the first session of the 76th Congress which are of more or less interest to the highway industry are the following:

Among the bills submitted, bearing on highways, is one by Mr. Taylor of Tennessee (H. R. 286), to authorize the appropriation of \$100,000,000 or so much thereof as may be necessary to locate and construct through the States of Virginia, North Carolina, Tennessee, Kentucky, West Virginia and the District of Columbia, a highway to be known as the Eastern National Park to Park Highway.

(Referred to the Committee on Roads.)

Also of interest to road builders in general is a Joint Resolution by Mr. Kennedy of Maryland (H. J. Res. 24), to create a Federal Highway Safety Authority, composed of representatives of the Federal Government to be designated by the President, and representatives of national organizations to be designated in the same manner.





Entire Drying, Mixing, Finishing and Rolling Equipment Lined Up to Work. This Lunch Time Pause Permitted a Picture of the Complete Outfit

## TRAVELING DRYER DEFEATS DELAYS OF WEATHER

*Sixty-three Mile Blacktop Paving Job Completely Mechanized*

By J. H. TILLER, JR.

*Superintendent\*  
Canada Construction Company*

**W**EATHER conditions and traffic obstacles on a 63-mile bituminous paving job in the Province of New Brunswick, Canada, resulted in the design of new equipment which should be of general interest. In an area of heavy rainfall, where no detours could be provided, and under a specification which required less than 1½ per cent moisture in the aggregate at the time of mixing with bituminous material, the 63-mile job, from Boiestown, N. B., to Douglastown, N. B., proved to be a field laboratory.

In the spring of 1936, the Province awarded to Canada Construction Co., Ltd., one of the longest single projects to be paved in that area. Forty-five miles of the 20-ft. paving is 3 in. thick, the remainder 2 in. thick. Grading was begun in 1936 and completed in the early summer of 1938. Surfacing was started in 1937. The heavy rainfall and frequent showers held up early paving operations until the moisture content of the aggregate could be properly controlled and yet produce a "low-cost" road. Traffic in the area is mostly the hauling of pulp and lumber and the road had to be kept open for it.

The material excavated from the pit usually contained more than 3 per cent moisture. This and the ever-

present threat of frequent showers, caused the development of a traveling dryer. The summer heat in New Brunswick is not strong enough to dry 3 in. of gravel rapidly enough.

The contractors, after receiving the award, began to investigate modern practices for mixing and placing bituminous mats according to the specifications. They decided to employ the Barber-Greene travel plant, mixer and finisher. This method enabled them to put down a 10-ft. width at a time, allowing traffic to pass without the usual delay of attempting to mix the complete road way at one time, and eliminated the possibility of being caught with a partially mixed section of roadway. The project was begun in early July, 1937, at Doaktown, N. B., the plan being to use hand labor and a motor grader to dry the material to the required moisture content for mixing. This plan was later changed to include a traveling dryer.

**First Arrangement.**—The aggregate was brought from the pit on flat cars with four-foot sides built up and the ends left open. This arrangement was made so that a bucket loader could be placed on the cars, working from one end of the train to the other, to unload the material to the trucks. To take the material away from

\*Now with Research Department, Barber-Greene Co., Aurora, Illinois.

the cars, five trucks were used, with additional trucks as the haul distance required.

The subgrade was first primed with between 3/10 and 5/10 imperial gallons of asphalt primer per square yard. The gravel was then placed in a windrow ahead of the mixer. The 20-ft. pavement required 800 cu. yds. for the 2-in. mat and 1,200 cu. yd. for the 3-in., per mile. The farthest point from the gravel pit was 75 miles and all gravel for the mix was hauled by rail to the various unloading points along the road.

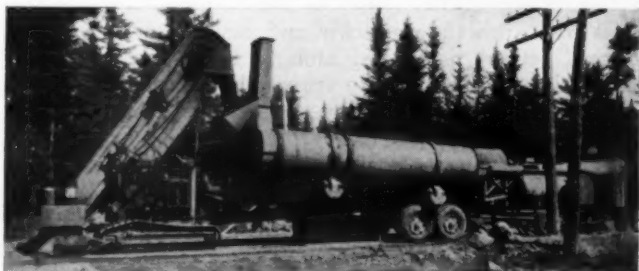
Specifications required that the surfacing be mixed and placed in one course and that the bitumen content should range from 3.5 to 4.0 per cent by weight. Following is a sieve analysis of the material:

Passing	Retained	Per Cent
1 in.	¾ in.	13.3
¾ in.	No. 4	20.0
No. 4	No. 14	15.5
No. 14	No. 48	42.5
No. 48	No. 200	7.5
No. 200	.....	1.2

It will be quickly seen that this was not an ideal aggregate gradation. The N. B. department realized that if a satisfactory mix could be obtained with such a grading, more satisfactory results would be obtained in future work with better graded aggregate.

The outfit operated as a regular travel plant, the windrowed aggregate being picked up by the bucket loader and discharged into the hopper of the mixer unit. The mixer accurately proportioned the aggregate and bitumen, thoroughly mixed the materials, and continuously discharged the mix at the rear. The finisher worked immediately behind the travel plant, receiving the mix directly from the pug mill spout.

With the beginning of work in July, 1937, it was



*Traveling Dryer Worked Ahead of the Mixer-Finisher During Favorable Weather*

plainly evident that the drying method was entirely unsatisfactory, due to the fact that on many occasions the material would be worked and aired, reducing the moisture content to that specified, only to have a shower come after a few hours run.

Test runs were made to ascertain the type of asphalt best suited for the job. RC-5 proved to be satisfactory, but due to the fact that the mixer discharged the mixed material less than two minutes after the aggregate and bitumen were combined, it was found that the normal naphtha content of the RC-5 could be cut to 12 per cent. This not only made a saving in solvent, but permitted the laying of the material without aeration, allowed rolling soon after laying, and gave a surface that would not groove under traffic.

After three months' operation in 1937, the paving unit had completed fifteen and one-half miles. Although the inclement weather had been anticipated, it had proven to be too costly a hazard. More miles had to be laid in the coming season, and the contractors wanted to retain

the many advantages of travel plant operation. A dryer had to be designed that was not only portable—but actually "traveling," one that could dry the windrow ahead of the travel plant and one that was, necessarily, equal to the capacity of the travel plant.

**Second Arrangement.**—This unit, which was designed by the Barber-Greene Co., was completed in May. It was immediately shipped to the job and started to work in early June, 1938. The dryer was a dual-drum design which was towed and fed by a practically standard bucket loader. The discharge of the loader was from two spouts universally hinged and arranged to feed equal amounts of material to the two drums. The angle of the drums could be quickly changed by a hydraulic hoist, so that adjustment was easily made according to moisture content of the aggregate or up or downhill operation. The drums were constructed to throw a continuous curtain of aggregate before the drying flame. The flame was furnished by a two-car heater which furnished steam, and "Bunker B" oil to the burners.

Experience with the dryer's operation indicates that the problem of building low-cost roads, in any climate of frequent rains, is simplified. Expensive and slower



*Closeup of the Mixer, Finisher and Roller Operating Directly After the Dryer*

methods of drying by hand and blade, and consequent delays, were eliminated. It was quickly demonstrated that only rain could stop the machine. After a heavy rain, no more than an hour was lost before paving operations could be resumed. The dryer was used just ahead of the travel plant mixer in threatening weather, and far ahead in fair weather.

During three weeks' operation in the month of June, 1938, the dryer enabled the mixer to place ten miles of black top which was equal to about two-thirds of the entire previous season's work.

**Advantage of Dryer.**—During the months of July, August, and September, 1938, the actual rainfall averaged forty-eight hours a week. This resulted in the material placed on the ground becoming saturated, a condition that showed the advantage of using the traveling dryer. This highly saturated material naturally caused the dryer to travel at a reduced speed, but, in considering the fact that as long as a week would pass without any appreciable sun, it was evident that no natural drying could take place; therefore, the result would have been that no surfacing would have been placed had the dryer not been available.

The first week of August (the only normal weather after July 1) 4.4 mi. of pavement, 20 ft. wide, were laid. During this period, 18 hours were lost by rain and the equipment moved back to finish the other half of the road.

It was stated by the engineers on the job that, with weather as normal as in 1937, the 48 remaining miles



would have been completed in 3 months; however, 4½ months were required. This was over three times as much mileage in an operating period only 50 per cent greater than that of 1937 when no dryer was used.

It was found that the dryer was easily removing from 4 to 10 per cent of moisture when handling from 80 to 100 tons an hour. Tests consistently showed a moisture content in the dried windrow of less than 0.5 per cent. After the material was once dried and left in a windrow behind the dryer, a shower would not dampen the gravel enough to need redrying. This was a great factor in the ability of the paving unit to begin operations only a few minutes after a shower had passed. The travel plant and finisher were able to handle as high as 2 cu. yds. of mixed material per minute, which in this case was the capacity required at a traveling speed of 18 ft. per minute.

**Continuous Operation.**—With the complete operation of drying and mixing being handled mechanically, the operation was continuous, night and day. The plants were lighted by two small generators. It was found that in a normal day's operation, one mile of 20-ft. pavement could easily be laid in 22 hours. To do this, the machines had to travel at a rate of 8 fpm. This is a slow speed, when considering that the entire outfit ran at a rate of 12 to 16 fpm with ease.

## DEVELOP PUBLIC GOOD WILL

**M**AINTENANCE departments' highway organizations are constantly on the firing line with the traveling public. Therefore, it is obligatory, for successful public relationship, that highway executives be imbued with the desire to build up an organization that will have efficiency, intelligence, diplomacy and a fighting esprit-de-corps. These are the seeds which grow good will; they are elements of a cooperative attitude toward the public.

In general, the closest contact that John Q. Public has with the efforts and work of a city street department or a state or county highway department is the ride he gets over a street or highway. If Mr. Public has just broken a spring on his car because he struck a bad hole in a paved surface he gets all riled up and demands of no one in particular, "Why don't they fix that?" If, on a rainy day he leaves, say, Baltimore for Frederic, in a hurry to get home by supper time, and skids off of one of those paved surfaces labeled, "Slippery When Wet," crushing a \$15.00 fender when he hits the ditch, he is not kindly disposed for some time thereafter and wonders why "they build such roads." Personally, I sympathize with the old gentleman. In fact, I get vitriolic about that condition. To me it is an advertisement of the criminal negligence of the state. These are only two examples of the multifarious means by which goodwill may be destroyed. Since the maintenance department of a state, city or county highway organization is the unit most closely in contact with the public, it is only natural to infer that "they" set the standard of acceptance for Mr. Public's support.

The time has come when John is probably not so much interested in the perpetuation of a highway department on account of new construction, as he is on account of adequate maintenance of surfaces already improved. The goodwill earned by the highway department has been gained to a large extent by the upkeep and improvement work that makes John's trips less tiresome, more rapid, and less costly. Of course, new construction is part of the whole picture, but John does not stop

to segregate the various parts. One section of the route he has decided to travel may be a recently completed modern highway. To John, it represents the easiest driving, smoothest, less tiresome and fastest part of the trip and he relaxes as he drives. His impression is not that it is new construction, rather that it is a good stretch. Whether designed and constructed by 1937 standards or 1930 standards makes no imprint on John. All he realizes is that the surface was smoother than the rest of the road, it was wider and driving was easier. The road might just as well have been a 1930 model, well maintained, so far as John is concerned.

The factors which contribute to the formula—smoother riding, more rapid travel and less expensive trips—are those myriad maintenance tasks which cause John to be satisfied with the work being done by his hired hands. That satisfaction is the basis of his good will. If he shakes his back teeth loose on a bridge approach or rattles all the bolts loose on his car on a corrugated, potholed, gravel road, he is angered. As he drives along he mutters uncomplimentary remarks about "they" and when opportunity presents itself he is not backward about lashing a critical verbal tirade at his hired help. (One may wonder how often the engineers' and commissioners' ears burn during the day.)

Just before an election, particularly, John starts talking about government expense, complaining about the high taxes (a characteristic human reaction) and his memory recalls the expense to which he was put to repair his car after he skidded off the road. He wonders what happens to his tax money. He waxes indignant, charges graft and inefficiency, and volubly expresses his righteous anger to his business friends and others. None of this, of course, can be added to good will by the highway department, none of it helps John's hired hands to get a raise in pay.

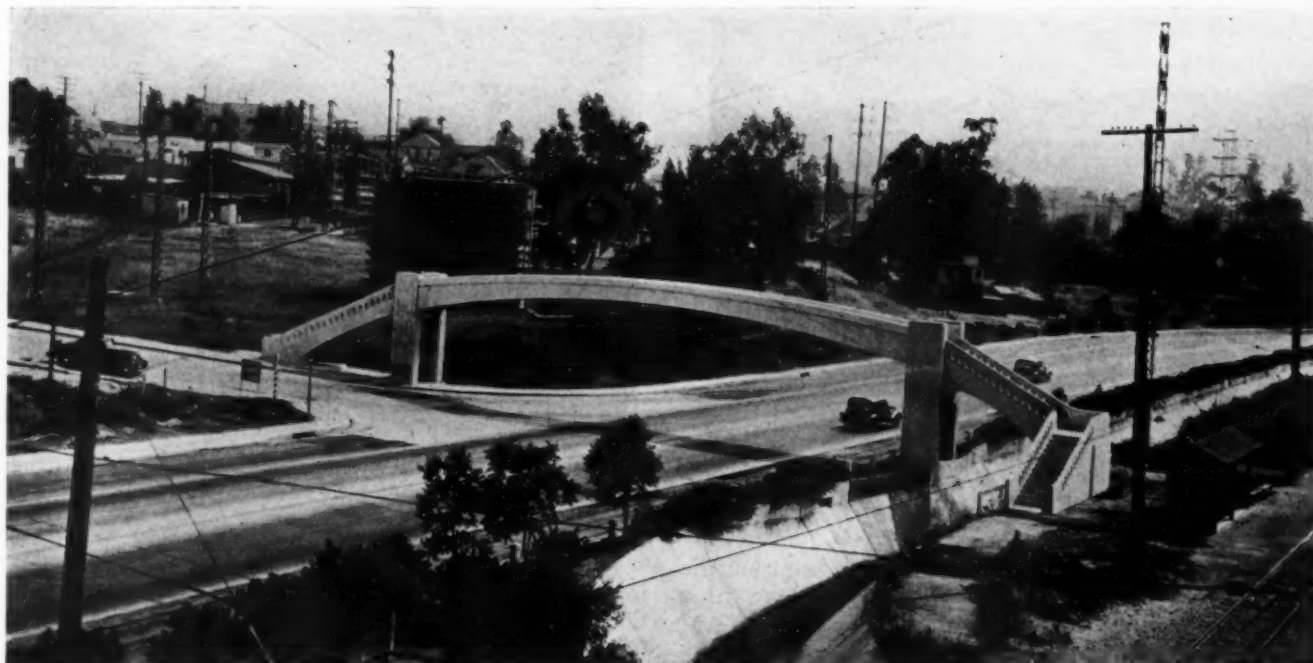
We all know how quickly and easily a derogatory or critical remark is passed along. For some reason or other that kind of gossip travels like electricity. It is harder to eliminate than the seven-year itch. And also, for some reason or other, John's friends are quicker to defame than to praise. Maintenance departments must realize these psychological attributes of Mr. Public and be governed accordingly. Unfortunately, there are not enough funds available to do all the work necessary to be done to fulfill the requirements of the formula we have established. There is a budgeted limit to expenditures. Consequently, maintenance departments must select the tasks most necessary and do them as economically as possible. The degree to which they provide safe, comfortable transportation with a minimum of delay and a minimum of out-of-pocket expense measures the amount of good will developed. The path to John Q. Public's heart for development of good will is not through his stomach (albeit that would be a big help), but through the effective road service afforded him.

A standing slogan of road and street administrative organizations should be, "Maintain Such as to Invite Traffic."

▼

**CONFERENCE ON SOIL MECHANICS**—The Second Annual Conference on Foundations and Soil Mechanics will be sponsored by the Bureau of Engineering Research and the College of Engineering of the University of Texas, in Austin, Texas, Feb. 3 and 4, 1939. Dr. Karl Terzaghi will give a series of three lectures at this Conference. Anyone interested is invited to attend.





*This Pedestrian Overpass Across Ramona Boulevard in Los Angeles, Providing Safe Access to the Railroad Station at the Right Is Real "Built-in Safety."*

## DEVELOPMENTS IN CONSTRUCTION AND DESIGN OF CONCRETE PAVEMENTS

By L. M. ARNIS

*Highway Engineer*

*Portland Cement Association*

**D**EVELOPMENT of concrete pavement practice has been rapid. The highway engineer has a feeling of pride in the excellent concrete pavements now being built. Although there are concrete pavements in use which date back as far as 1893, most of the progress has occurred in the last 2½ decades. The amount of concrete pavements built in the United States prior to 1914 is equivalent to less than 1 per cent of that laid since 1914. During the last 24 years concrete pavement construction has changed from a hand operation with comparatively crude equipment and methods of control to a highly mechanized and carefully controlled operation in which little is left to chance.

The change has been a gradual one. The difference in practice between any successive years has been small. But the sum of 24 such differences represents the revolutionary difference between 1914 practice and 1938 practice.

### Research Points the Way

The advancement continues, guided by research, carefully planned and carried out in a conscientious and open-minded attitude. A study of the reports of the Highway Research Board for the last five years shows that not less than 67 of the papers there presented have been on concrete pavements or on a subject which has rather direct bearing on their design,

construction or use. In addition, many papers discussed subgrades, fills and other subjects indirectly connected with the concrete pavements. This is the record of only one national organization. Many others are doing creditable work along similar lines. As long as this intense interest in research is maintained, the development of concrete pavements will continue to advance.

### Current Trends

A study of research projects of recent years is a good guide to current trend in design and construction. The changes from year to year are today no more pronounced than in the past, but the progress is just as positive. A brief review of current practice will show the direction in which we are moving.

### Jointing Practice

Recent years have seen much research into the problems of load transfer devices, fillers and seals at joints. It is not surprising, therefore, to find that changes are now developing in jointing practice. It is perhaps too early to say just how far these changes will go but present trends are definitely toward longer spacings between expansion joints and shorter spacing between contraction joints. Where dowels are used the movement is toward shorter lengths and possibly larger diameters.



*This New Entrance Into Portland, Ore., Has a Narrow Separation Strip of Contrasting Color Which Does Not Provide a Positive Separation.*



*This Is a Portion of the Midwestern Express Highway Connecting Chicago and Milwaukee.*

In hinged joints, shorter tie bars are being used but the spacings are being reduced, the trend being toward a maximum spacing of about 2 ft. 6 in.

Highway departments and material producers have been experimenting with joint sealing materials which have approximately the same characteristics throughout the range of temperatures to which pavements are subjected. Some of the materials which have been developed give promise of remaining plastic enough to retain their waterproofing properties during winter weather without becoming so soft as to be unusable during the hot summer months. One obstacle to further use of these materials to date has been their comparatively high cost. Engineers of the California State Highway Commission have developed an oil-latex compound which appears to give excellent results at a moderate cost. Undoubtedly all producers will be able to lower their costs as demand and production increases.

### Express Highways

Continued increase in traffic volume and interest in public safety are making more apparent the need for express highways, especially in suburban areas. This need is being substantiated by preliminary data compiled in the State-wide Planning Surveys. H. S. Fairbank of the U. S. Bureau of Public Roads has estimated, largely from results obtained on these surveys, that over 1,000 miles of divided multiple lane express highways should be built each year for the next 20 years to keep up with normal growth in traffic during that period.

In this fascinating new field, engineers are able to put into effect ideas which could not be used in less ambitious construction. There is, as yet, a refreshing lack of uniformity or standardization. With few precedents to guide them, designers are now preparing plans for roads which, when they are in service, will point the way and supply the data needed for the fixing of future standards. From these plans a few trends begin to appear.

Wider traffic lanes are coming into use. Where 10-ft. lanes were formerly considered adequate, 11-, 12- and even 13-ft. lanes are being used. On divided highways it is not uncommon to see the outer lanes 1 or 2 ft. wider than the inner lanes. This provides more room for heavy trucks which will normally operate on the outer lanes and offers some inducement to passenger cars to use these lanes, thus leaving the inner lanes free for passing.

The width and treatment of the neutral strip between the pavements differs widely. In the western states the strip is generally much narrower than in the east. It is not yet apparent whether this difference is due to necessity for keeping costs lower in the west or to the need for more frequent cross-overs in the densely settled east. Where the strip cannot be made wide enough to provide a stopping place for cars crossing the highway, the minimum width now used is about 4 ft. However, if a 4-ft. strip is to provide for *positive* separation of the roadways, it is necessary to add curbs, the cost of which will partially offset the saving in grading and right of way. The trend appears to be to make the separation,



*"High Visibility" in Curbs Is Obtained by Using White Concrete or by Corrugating the Curb Faces So That They Catch Headlight Beams and Reflect Them Back to the Driver.*





*The Wide Separation Between Roadways on Saw-mill River Parkway, Westchester Co., N. Y., Is Narrowed Down Where Conditions Require It.*

wherever possible, wide enough to provide a space for cars to stop in crossing the highway or in turning to the left from either roadway. About 20-ft. width will do this satisfactorily. Where crossroads are infrequent, this width of separation may be reduced between intersections.

On some roads the separation has consisted of a slightly elevated strip paved with a material of contrasting color. On others, short transverse ridges or "ripples" of concrete are built along the center line to warn motorists that they are encroaching on lanes intended for traffic in the opposite direction, without actually preventing the use of the lanes for passing when needed. These devices permit the separation of two-lane highways where a positive separation would make it impossible for a fast-moving vehicle to pass a slow-moving one. More experience is required to determine the practicability of these devices.

### Construction Methods

Improvement of all construction machinery continues. The use of vibration is spreading, as it was certain to do after research by the U. S. Bureau of Public Roads and several of the state highway departments had pointed out its possibilities. This is a field in which further developments may be expected as problems of application are eliminated.

New finishing machines are producing surfaces which provide easier riding qualities and freedom from irregularities.

A trend continues toward better grading of aggregates to secure greater density, improved workability, and greater economy. This is accomplished through use of two or more sizes of coarse aggregate and in some instances by increasing the percentages of fine materials in the sand.

Material engineers are accumulating a valuable collection of experience data on performance of various aggregates. From study of these data, specifications are gradually being revised to eliminate those mate-



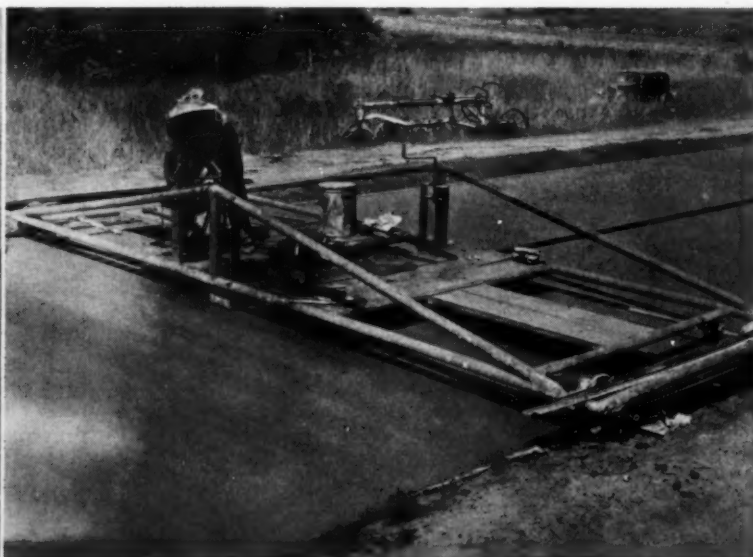
*A Completed Permanent White Traffic Line in Wayne County, Michigan.*

rials whose performance record is not satisfactory.

### Traffic Aids

There is an increase in the use of built-in traffic lines. These range from a dusted-on and floated-in color which Texas builds at a cost said to be well under 1 ct. per linear foot to an inlaid mixture of white or colored concrete using special aggregates. Construction is simple. Annoyance and cost of periodic repainting of traffic lines are avoided.

To still further increase the safety characteristic in-



*Texas Builds an Inexpensive Permanent Traffic Line by Dusting a Black Pigment onto the Fresh Concrete and Floating It In. The Operator Works from a Movable Bridge.*

herent in the light-colored, highly visible concrete surface, increasing use is being made of concrete curbs designed to give maximum visibility. White concrete curbs are being widely used and both white and standard grey curbs are constructed with corrugated faces to catch the light from automobile headlamps from any angle and



This Permanent White Traffic Line Is Built by Inlaying a Mixture of White Concrete in a Groove Which Is Left When the Pavement Is Laid.

reflect it back to the motorist. Both precast and cast-in-place construction have been used.

### Continued Progress

The development of concrete pavement continues. Without sensational changes, advancement follows along paths pointed out by careful research and experimentation in laboratory and field. With this intelligent guidance, road builders may be assured of continued progress and service.

## BOOK REVIEWS

**University of Illinois Bulletins.** The four publications here listed were issued in August, and may be obtained without charge upon application to Engineering Experiment Station, University of Illinois, Urbana, Illinois.

**Circular No. 32, "Two Investigations on Transit Instruments,"** by William H. Rayner. The purpose of the investigation was to compare the errors of reading verniers on transits under various conditions, and to determine the relation between the line of sight and the axis of the objective slide in transit telescopes.

**Bulletin No. 302, "Fatigue Tests of Riveted Joints,"** by Wilbur M. Wilson and Frank P. Thomas. The object of the investigation was to determine the fatigue strength of riveted joints connecting structural steel plates.

In the specimens tested all rivets were in double shear, and all had a nominal diameter of one inch. Some specimens were designed for rivet failures, others for plate failure. The variables studied included the grip of the rivets, the relation between unit shear, unit bearing, and unit tension, the transverse distance between rivets, combinations of carbon-steel and manganese-steel rivets with carbon-steel, silicon-steel, and nickel-steel plates, and the methods of making the rivet holes—punched full size, sub-punched and reamed, and drilled from the solid.

**Bulletin No. 303, "Solutions for Certain Rectangular Slabs Continuous Over Flexible Supports,"** by Vernon P. Jensen. In the design of bridge slabs subjected to wheel loads, certain questions have remained unanswered or only partially answered in spite of the considerable progress that has been made during the past decade. These questions pertain to the effect of continuity of the slab across stringer or floor beams, to the effect of curbs and diaphragms, to the effect of flexibility of the supporting beams, to the sufficiency of design on the basis of moment only, and to numerous other elements of undoubted importance in the proper design of slabs.

**Bulletin No. 304, "A Distribution Procedure for the Analysis of Slabs Continuous Over Flexible Beams,"** by Nathan M. Newmark. The purpose of Bulletin No. 304 is to explain a method of analysis for certain types of continuous slabs subjected to concentrated or distributed loads. In order to study such problems as the effect of wheel loads on a slab continuous over steel stringers, or on a single-span bridge-slab with integral curbs or other stiffening beams at the edges, it is necessary to have a rapid method of analysis.

Analytical procedure does not, of course, answer all questions that arise in connection with the design of a slab. The analysis presented in this bulletin applies to a structure with certain ideal properties, but does not deal with such problems as the ultimate strength of the slab, effects of temperament, shrinkage, and exposure to weather.

**Bibliography of the Literature of Explosives.** The Bureau of Mines, U. S. Department of the Interior, issued the following announcement on Aug. 18.

Dr. Charles E. Munroe, when Chief Chemist of the Explosives Division of the United States Bureau of Mines, gave extensive consideration to the bibliography of the literature of explosives. His manuscript bibliography, comprising 794 pages, covers practically all the important journals prior to 1907, when Chemical Abstracts began. The titles and authors are given chronologically by journals. Dr. Munroe retired from the active service of the Bureau of Mines before he could provide the work with author and subject indices.

**Lefax Traverse Tables.** Lefax, Inc., Ninth and Sansom St., Philadelphia. 92 pp. 2¾x6¼ in. Loose leaf. Price, complete in paper cover, \$1.50; in Faxide binder, \$2.25; in Morocco binder, \$3.00.

This table is an extension of a table of natural sines and cosines for each minute of the quadrant. Ten latitudes and ten departures for each degree and minute are ranged in parallel columns, with a narrow blank between them. All figures are carried to five decimal places. J. T. Boileau's "Traverse Tables" form the basis of this pocket-size volume.

**Trade Standards—Compressed Air Industry,** by Compressed Air Institute, 90 West Street, New York City. Wire binding, 112 pp., 8½ by 11 in. This is the fifth edition.

It is more than double the size of the previous edition, and includes such new material as sections on rotary compressors and vacuum pumps, centrifugal compressors and blowers, compressor accessories, rock drills and pneumatic tools; additional charts, tables and data; also an up to date revision of material previously published on reciprocating compressors and vacuum pumps (stationary type), portable compressors, and a description of the method of testing displacement compressors, blowers and vacuum pumps conforming to the revised A.S.M.E. Code now under preparation.



# RECENT BRICK PAVEMENT DEVELOPMENTS

By GEORGE F. SCHLESINGER,

*Engineer-Director  
National Paving Brick Association  
Washington, D. C.*

THE National Paving Brick Association recognized that research is an essential and component part of progress when a number of years ago it established a Research Bureau at the Ohio State University Engineering Experiment Station, Columbus, O. The Bureau has the general supervision of Dr. G. A. Bole, the nationally recognized ceramic authority, and is in direct charge of Mr. H. Z. Schofield. Several of the experimental projects were conceived by members of the Association and the Research Bureau has lent its advice and cooperation. The developments described in this article are current but as noted in some cases the studies are still in progress and final conclusions will have to await additional evidence of the future.

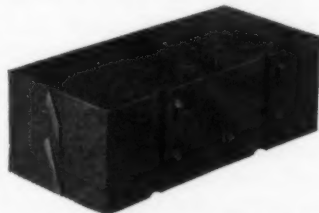
## Standard Types and Sizes

Since 1921 the Division of Simplified Practice of the National Bureau of Standards, through a committee composed of representatives of engineering and technical societies, has annually recommended a standard list of sizes and varieties of paving brick.

Following is the recognized list of types recommended by the Committee at its meeting in Washington, D. C., on April 29, 1938:

Variety	Size, Ins.			1937 Shipments Per Cent
	Depth	Width	Length	
Repressed lug .....	4	3½	8½	6.9
Vertical fiber lug.....	2½	4	8½	9.3
Vertical fiber lug.....	3	4	8½	49.3
Vertical fiber lug.....	3½	4	8½	14.3
Total .....				79.8

It will be noted that the list does not contain any lug-less varieties which at one time were in general use in the western part of the United States. The proportion of vertical fiber lug brick shipped in 1937 (72.9 per cent) is by far the greatest for any type. This type is laid with the wire cut skid-resistant side in the traffic surface.



*Vertical Fiber Lug Type of Brick with Lugs*

## Specifications

Practically all standard specifications for the physical qualities of paving brick used by specifying authorities are identical with, or in essential details, based on those of the American Society for Testing Materials. The requirements in regard to the abrasive loss in the rattler test are sometimes varied (usually downward) to apply to the quality of brick available in a particular locality. The standard specifications for paving brick of the A. S. T. M. had not been revised since 1929 until 1937 when new "Tentative" specifications designated as

C7-37T were adopted and the old standard withdrawn. The most notable innovation is the additional requirement to the rattler test limiting the number of broken pieces weighing 1 lb. or more. Some specifications, such as those of the Highway Department of the State of Ohio, had in recent years added a test for flexural strength. An investigation indicated that there was close coordination between broken brick in the rattler and low flexural strength. It is believed that a broken brick requirement will be more determinate than the flexural test and in addition it is considered a criterion of toughness.

The enviable service record of brick paving is a source of pride to the producers of this time-tried material, but the industry and its national association recognizes that the present standard methods of laboratory acceptance tests were adopted when the principal type of traffic vehicle and mode of its operation differed greatly from what obtains today. If testing procedure more applicable to existing conditions can be developed the industry certainly has much at stake. It is, therefore, at this time cooperating with the U. S. Bureau of Public Roads and the Ohio Highway Department in a study of possible desirable changes in specification requirements. A 3½-mile paving project on route U. S. 23 north of Delaware, O., completed in December, 1938, consisting of equal sections for which brick were furnished by 16 manufacturers will provide a means for coordinating laboratory tests with service performance. Laboratory examinations of the brick used in the test pavement are now under way. The National Paving Brick Association is represented in this investigation by Mr. H. Z. Schofield, Director of its Research Bureau.

## Construction and Design

The type and quality of the paving brick unit is a matter of fundamental importance but its method of utilization is at least of equal moment. Brick units in the pavement are surrounded and supported by a number of other materials of construction. The excellence of the pavement structure as a whole is the objective of design and construction requirements. Many of the recent researches and developments have to do with improvements in what may be termed auxiliary materials and the manner in which they are used.

## Rolling

Rolling on boards is a recent innovation in rolling the brick, after they have been laid and before filling. This method originated in Richmond, Va., and is meeting with increasing favor elsewhere. It was required on the Lincoln Tunnel pavement under the Hudson River at 38th St., New York City. It has the advantage of permitting the use of heavier rollers such as most contractors have on hand for sheet asphalt con-



*Rolling Brick Pavement on Boards Prior to Filling on Brick Resurfacing Project on Fourth St. in New Philadelphia, O., Constructed in 1938. Note That a Heavy Three-Wheel Roller Is Being Utilized.*

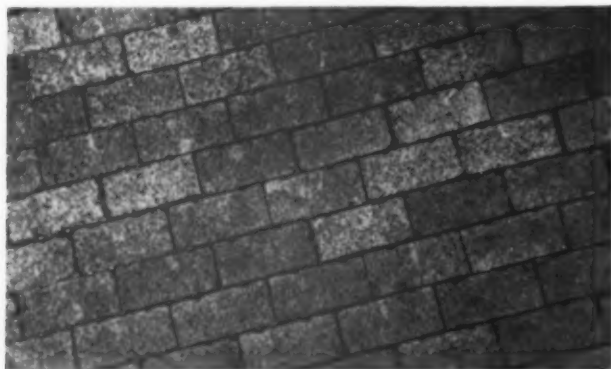
struction. The brick are uniformly embedded vertically with the minimum displacement laterally. The joint lines remain straight which is desirable from the standpoint of appearance. Following is the requirement quoted from the Richmond Specifications:

"After the bricks have been laid, the lines straightened, the surface swept free of chips and the work approved by the Inspector, the brick shall be rolled with a power driven tandem roller weighing not less than five nor more than ten tons. Rolling shall be done longitudinally *on boards* not less than 10 in. wide and 12 ft. long, dressed to a uniform thickness of 13/16 in. laid longitudinally and in close contact. Rolling shall start at one curb of the street. The roller shall not progress more than 10 in. transversely at each longitudinal roll. Sufficient boards will be required for longitudinal rolling of 24 ft. Boards which became split or broken shall be replaced."

On the Acceptance Test Road on Route U. S. 23 in Ohio mentioned previously halves of each section were rolled on boards and the subsequent results will be compared with the portions rolled according to usual specification requirements.

### Fillers

An important part of the work of the Research Bureau of the National Paving Brick Association has been concerned with the development of paving brick joint fillers that are non-exuding in hot weather. Consideration has been given to cement grouts, bituminized cement grouts, plasticized sulphurs and bituminous fillers. Among the bituminous fillers, comparisons have been made between asphalts from different base crudes,



*Close-Up View of Lincoln Tunnel Pavement after about One Year in Service. The Low Exuding Type of Asphalt Filler Is Flush with the Surface and Has Not Exuded and Covered Any Appreciable Portion of the Pavement, Thus Retaining Its Original Skid-Resistant Property.*

asphalts of different softening points and penetrations, asphalt mastics and straight pitches and pitch mastics. In the laboratory the properties and behaviors of the fillers were observed and interpreted in terms of practicability. Special emphasis was given to a test wherein the exuding or receding tendencies of the bituminous fillers were observed by subjecting filled brick panels (of about 1 sq. yd. area) to prolonged periods of simulated summer temperatures. From these tests a number of fillers were selected as worthy of actual pavement trial.

In cooperation with the Ohio Department of Highways and the U. S. Bureau of Public Roads, a project was planned and completed (November, 1935) in which the entire length of 1 1/4 miles of new brick pavement on Ohio Route 31 in Hocking County, Ohio, was allotted to a test of fillers. Of these fillers 13 are in sections exceeding 300 ft. in length and eight in sections somewhat shorter. During construction, observations were made to determine the practicability of application, including the surface removal of the fillers. Since completion of the pavement thorough inspections of the fillers under service have been made periodically.

The following year the Ohio Highway Department, basing its selection on favorable behavior in the test road, designated four of the fillers for more extended use and further trial in brick pavement projects. These four fillers were made optional and as a result only one type was used by the contractors. It was an asphalt having a higher softening point (101°-110° C.) and a lower penetration (23 to 32 at 25° C.) than in the standard filler used heretofore. A recent survey of completed pavements on which this filler was used last year indicates a definite reduction in exuding. The filler for the Lincoln Tunnel pavement was of the same low exuding type and it has been used with satisfactory results on other projects.

In the surface removal method of filler application, penetration of the separating agent into the vertical joints is undesirable and is prohibited by standard specifications. The prevention of leakage requires rigid field control and the Research Bureau of the National Paving Brick Association is now engaged in developing application methods that will make the required results more certain in practice. With the removal of the excess mat on top a more thorough inspection of the pavement is possible. One consequence has been the requiring of end lugs instead of beveled ends (bulged). These lugs on each end are non-meshing so as to provide for free flow of filler and function equally well when the brick are turned.

### Base Courses

The requirements for foundations or base courses will vary according to local conditions of climate, subsoil and traffic loads. In the southern section of the country, vitrified brick surface courses are successfully used on such foundations as natural sand, sand-clay, gravel, crushed stone, slag, shell and Florida lime rock. Brick pavements have, of course, given excellent service on macadam, black base and concrete.

Concrete is the material commonly used as a foundation course for city streets and heavy traffic pavements. With proper subgrade conditions most engineers, particularly for city pavements, prefer a relatively lean concrete for the base. It will be less affected by temperature changes and, because of lower tensile strength, cracks that form are smaller and more dispersed, have greater resistance to displacement and are less likely to affect the surface. Reinforcing with steel fabric mesh or bar mats, usually in lieu of a richer



concrete, is an increasing practice. Expansion joints in base course are the cause of disturbance of the brick surface and are advised against. With plain concrete, transverse weakened plane or construction joints are used to some extent. Center longitudinal joints with dowels, at lane intervals, similar to those in concrete pavements should be used. With integral curbs, which perform the same functions, thickened edges are not required.

### Vibrated Monolithic

In connection with a discussion of joints in concrete bases it is pertinent to mention that the monolithic type of brick pavement shows indications of revival. In this design the brick without cushion are laid directly on the green concrete base and filled with cement grout. On an experimental brick road on Ohio Route No. 43 in Carroll County, constructed in 1933, a section of monolithic was included. The pavement had a longitudinal center joint and 1 in. transverse expansion joints at intervals varying from 50 to 100 ft. A smooth surface was obtained and the section is now in practically perfect condition.

A monolithic brick pavement over 2 miles in length constructed the past season on Route U. S. 21 in Stark County, Ohio,\* has awakened renewed interest in this type. The design consisted of a 3-in. monolithic brick surface course (without cushion) on a 9-7-7-9 in. reinforced concrete base course. There was a 1-in. expansion joint at 60-ft. intervals with a longitudinal center joint. The transverse expansion joint was of the assembled metal type with dowels and bituminous premolded filler with a cork extension in the brick surface. This joint is continuous from the bottom of the base to the top of the surface. The longitudinal center joint consisted of premolded material which extended  $2\frac{1}{2}$  in. in the concrete base and had a total depth of  $5\frac{1}{2}$  in.

The project differed both in design and in methods of construction from the old type of monolithic brick pavement as constructed a number of years ago. As indicated above, there is proper provision for expansion and the elimination of haphazard longitudinal cracking. The most striking feature, however, is the fact that the construction methods were mechanized to a large extent. The concrete base was vibrated with a concrete pavement vibrating machine and the longitudinal center joint was impressed with Flexible Road Joint Equipment as in concrete construction with the exception that the premolded material was left 3 in. above the top of the concrete to accommodate the brick surface. After the brick were laid directly on the green concrete base they were vibrated into place with a motorized self-propelling machine that traveled on the steel side forms. The vibration at the rate of 3,600 blows per minute was transmitted to the brick surface through longitudinal metal slats, 12 in. wide and 6 ft. in length. A surface well within the specification requirements for smoothness was obtained. The grout filler was discharged on the surface of the pavement direct from a small mixer which was mounted upon a rolling carriage and segregation of aggregates was thus eliminated.

### Longitudinal Laying

In December, 1936, the Ohio Highway Department completed with Federal aid the construction of a section of brick pavement on Route U. S. 33 located a short distance from the filler test road previously mentioned, in which the brick were laid longitudinally—that is with the

$8\frac{1}{2}$ -in. dimension parallel with the curbs. Longitudinal laying was not a complete innovation as it had been used previously notably for car track areas, parking strips, on grades, and to a limited extent in normal installations. However, this project was the first of its kind using modern construction methods. Contemplated advantages included smoother riding, reduction in traffic noise, spanning of base cracks lengthwise, a reduction in breaking of brick for transverse closures, economy in labor of laying because of unlimited length of rows and the elimination of special wedge shaped sections on curves. The project, completed in 1936, was 1.35 miles long, 20 ft. wide over-all, 3 in. fiber lug brick on a concrete base, with 9 in. integral curbs using standard asphalt filler. An extension of this project for 1.5 miles using low exuding filler was completed in 1938. The specifications for the first project did not permit "batting" but it was necessary at infrequent intervals to cut brick at transition points. Also because brick were re-spaced or shifted on the cushion, the resulting surface contour was not as smooth as expected. Quoting from the specifications for the second project: "Where the width of the longitudinal courses of brick is such that the entire width between curbs is not covered, transverse batting will be permitted at one curb. In no case will bats shorter than one-half brick be permitted." The appearance of the pavement was not noticeably affected because of permissible batting at one curb and economy in laying and an even smoother surface than in the first project was the result. By comparison with an adjoining transversely laid section completed at about the same time there was a small reduction in cost of laying and in quantity of brick required per square yard.

Continuous longitudinal joints were of evident disadvantage when traffic was predominantly of the steel-tired type. However, this type of traffic is practically nonexistent today. The performance in service to date of these projects has been impressive and in the opinion of some observers the advantages of longitudinal laying may have sufficient value to justify a change in present practice.

### Reinforced Brick Pavements

Reinforced brick masonry in which steel rods are embedded in the mortar joints has been used to an increasing extent in recent years in building construction, particularly in California where it is considered desirable because of possible earthquake disturbances. In June, 1931, a reinforced brick pavement slab was installed in



Setting 8 in. x 8 in. x  $3\frac{3}{4}$  in. Vitrified Block in Welded Bar Mat Section of Experimental Reinforced Brick Pavement Constructed on Route U. S. 23 in Ohio in 1938.

\*For a detailed description of this project, see article by L. L. Luke in *ROADS AND STREETS*, November, 1938.

the driveway entrance to the plant of a paving brick company in Illinois. Brick were placed in a "basket weave" manner with three brick 4 in. in depth constituting a unit. Reinforcement of  $\frac{3}{8}$  in. round deformed bars was placed at  $8\frac{3}{4}$  in. centers both ways, 1 in. from the bottom and all joints filled with 1:2 cement mortar. Two weeks after the slab was completed an excavation was made under one side, creating a clear span of 5 ft. It is estimated that during the past seven years 30,000,000 brick have been trucked over the pavement which shows no sign of distress over the span.

Based on the success of this experiment an additional test section 38 ft. wide by 75 ft. long was installed on West Grand Ave. in Springfield, Ill., in September, 1937. Instead of using standard paving brick in basket weave pattern, large vitrified units  $3\frac{1}{2}$  in. x 8 in. x 8 in. were manufactured. They were laid by hand in checkerboard pattern, properly spaced, and reinforcing rods placed in two directions in the cement grouted joints. Transverse expansion joints will be necessary in a long project although volume change due to thermal expansion and moisture will be less than for concrete.

In August, 1938, the Ohio Highway Department and the National Paving Brick Association constructed another test project on route U. S. 23 immediately north of the acceptance test road previously referred to. It is 20 ft. wide, 200 ft. long and three types of reinforcing were used—loose bars, bar mats, and welded wire fabric. The units are  $3\frac{3}{4}$  in. x 8 in. x 8 in. The foundation is old macadam, scarified, widened and rolled, with a thin stabilized crushed stone leveling course. If a practical success, this type of pavement will not require curbs or headers and will have all the advantages of rigid slab construction with the addition of durability inherent in hard burned vitrified clay products. Arrangements have been completed for further study in the laboratory and field, including strain measurements, with a view of developing a rational theory of design.

### NATIONAL PAVING BRICK ASSOCIATION TO MEET IN FEBRUARY

The 33rd annual meeting of the National Paving Brick Association will be held Feb. 1, 2 and 3, at the Deshler-Wallick Hotel, Columbus, O. In addition to the business meetings many of the sessions will be open to the general public. Those interested in street and highway development are cordially invited to attend.

The program will include papers and discussions by prominent engineers and contractors experienced in the use of brick for paving purposes. Important recent developments in manufacturing, in the technique of testing and in construction practices will be considered. Among the subjects to be included are the vibrated monolithic pavement, the additional experience with reinforced slabs and with the longitudinal method of laying, which are new uses of paving brick during the past year that have attracted widespread attention in the highway technical field. The Research Bureau of the Association is located at the Ohio State University Experiment Station in Columbus and opportunity will be afforded to inspect the laboratory and service studies. The Research Bureau, in its annual report, will also present data regarding the skid-resistant properties of the brick surface

by the use of the low exuding type of filler which was developed as a result of several years' research.

The adaptability of brick as a heavy duty type to the "highway of tomorrow" will receive attention.

C. C. Blair, head of the Metropolitan Paving Brick Company of Canton, Ohio, is President, and George F. Schlesinger, 1245 National Press Bldg., Washington, D. C., is Chief Engineer and Secretary of the National Paving Brick Association.

### PEDESTRIAN UNDERPASS OF PIPE

Pedestrian underpasses are becoming a greater necessity under highways as well as railways. The accompanying illustration shows how the city of Davenport, Iowa, gets its school children and others across the main line of the Rock Island Railroad without endangering their lives.

The job consists of an elliptical-shaped Armco multi-plate pipe 84 by 96 in. which was installed a few years ago by the Armco jacking method without disrupting the roadbed or hindering railway traffic. Note the exterior and interior lights and the drains in the concrete floor in the bottom of the pipe.



*Pedestrian Underpass at Davenport, Ia.*



# TEXAS WELCOMES STATE HIGHWAY OFFICIALS BY WORD AND DEED

## *Successful Annual Convention Followed by Motor Caravan*

CONVENED at Dallas, Texas, December 5 to 9, 1938, was one of the most successful of the annual meetings of the American Association of State Highway Officials. It was followed by what was many times called the "best" caravan tour of these meetings. Texas was the host to the convention and the Texans did a high-grade job.

Meetings were open to those who desired to attend, a commendatory practice. Considerable interest was attached to the general meetings, as evidenced by the attendance. It was at the committee meetings of the departmentalized groups that detailed work was accomplished.

Following are the resolutions adopted:

### LIMITED ACCESS HIGHWAYS

"Whereas, state highway departments render to the people of the United States and to the people of their several states a valuable service in providing efficient and safe highway transportation, and

Whereas, the state highway departments of the several states are charged with the responsibility of selecting routes, designing, constructing and maintaining state highway systems, therefore be it

Resolved: That legislation be sought wherever practicable in every state of the Union to give to the state highway authorities wherever they are not already in possession of it:

1. Authority to build limited access highways in suitable locations.
2. Authority to acquire sufficient width of rights of way to protect the public investment in the highways and to reduce hazards.
3. Authority to make and enforce regulations controlling the uses of private property abutting on state highways."

### PUBLICATION OF CONVENTION PROCEEDINGS

"Whereas, the work of the American Association of State Highway Officials is becoming more important each year, inasmuch as it furnishes a clearing house for the ideas of the highway engineers of this nation relating to the design, construction, maintenance and operation of highways, and

Whereas, the editing and publishing of the proceedings of this association is necessary if the full value of the association's efforts are to be realized and this wealth of information preserved for reference, and

Whereas, the cost of such publication is insignificant when compared to the cost of assembling the delegates in annual conventions,

Now, therefore be it Resolved: That this association in convention assembled at Dallas, Texas, recommends to the Executive Committee of this association that a special committee be provided and its members be appointed to receive and edit the material presented at the several group meetings of the annual conventions and that the edited material, together with the addresses of the main sections of the conventions, be published following each annual meeting."

### MODEL CODE OF MOTOR VEHICLE LAWS

"Whereas, a revision of the Model Code of Motor Vehicle Laws and the Model Municipal Traffic Ordinance was made July 11 to 14, 1938, by representatives of this association and of the National Conference on Street and Highway Safety, constituting the joint Legislative Committee on Uniform Traffic Laws, and

Whereas, the said revision is recognized as constituting the basis for uniform legislation referring to the licensing, registration, operation and administrative control of motor vehicles and of motor vehicle traffic, therefore be it

Resolved: That this association recommend to the legislatures of the several states that they amend the laws of their respective states to bring them into conformity with the code as now revised."

### ADVERTISING ON HIGHWAY SIGNS

"Whereas, the association is of the opinion that the display of any advertising or other extraneous matter on highway signs or markers intended for the guidance, warning or instruction of the traveling public seriously detracts from the efficiency of such signs, and

Whereas, the association opposes the use of miscellaneous advertising or other unnecessary signs on highway rights of way, and

Whereas, the model code contains a clause prohibiting the use of advertising on any standard sign or marker or on any post or support of such sign or marker, therefore be it

Resolved: That this association hereby condemns such practice and urges upon all state highway departments and other governmental agencies responsible for the use or installation of such standards that they prevent the display of any advertising matter thereon or the use along the highway of miscellaneous signs carrying distracting or extraneous matter."

### NATIONAL DEFENSE

"Whereas, unsettled and chaotic political conditions throughout the world tend to focus national attention on the subject of Adequate National Defense, and

Whereas, any well considered plan for national defense will require a comprehensive system of improved highways for the rapid and efficient transportation of men, materials, and food supplies, and

Whereas, any system of highways that will adequately serve the military needs of the nation will likewise be of immediate and continuing value to our people in times of peace, and will be a sound economic investment, whether ever needed for national defense or not, and

Whereas, the building of a system of highways that is adequate for national defense will not only add to our tangible national wealth in full proportion to expenditures made, but also provide sorely needed employment of a diversified nature throughout the nation, now therefore be it

Resolved: That the attention of the President and Congress be called to this vital phase of our national defense problem, and be it further

Resolved: That this association hereby tenders its services to the President and the Congress, and respectfully suggests that the United States Bureau of Public Roads and the State Highway Departments of the several states are experienced agencies at their disposal for carrying out any road-building program that might be considered essential to a national defense program."

#### STATE-WIDE HIGHWAY PLANNING SURVEYS

"Whereas, state-wide highway planning surveys have been undertaken and for various periods have been in progress in forty-six (46) states, and

Whereas, in the majority of such states the greater part of the information sought has been obtained and is now being compiled and analyzed, and

Whereas, the information thus being made available is especially needed at this time for decisions in respect to the broad policies that are to govern further development of the means of transportation, and

Whereas, such information is also constantly needed in the daily operations of the federal and state highway authorities, and for such current use it is essential that the basic facts already amassed shall be constantly revised to reflect changing conditions, now therefore be it

Resolved: That the facts already recorded shall be made available promptly and used for all proper purposes of current operation, program planning, and policy development, by both state and federal authorities; and that arrangements be made by each state highway department without delay to establish the organization and routines necessary to insure the essential current revision and use of the basic facts."

#### EXPRESSION OF APPRECIATION TO THE CONGRESS OF THE UNITED STATES

"Whereas, the 75th Congress authorized appropriations for the fiscal years 1940 and 1941, to aid the states: in the construction of regular federal aid highways, and secondary and farm to market roads; in the elimination of hazards to life at railroad grade crossings; in the construction of forest roads and trails and main roads through public lands; and for roads in the national parks and parkways, and Indian reservations, roads and trails, therefore be it

Resolved: That the American Association of State Highway Officials in Convention assembled at Dallas, Texas, December 8, 1938, expresses to the Congress and to the President sincere appreciation for this action, and reaffirms its position: that, inasmuch as the needs for highway development, and for the promotion of safety thereon, are still far ahead of actual accomplishment; that continued federal and state cooperation is required in order to assure a highway system adequate to serve our needs in peace time and for our safety in times of national emergency; and that federal authorizations should thus be made in advance to enable state law-making bodies and highway departments sufficient time to provide local funds and carry on orderly and consistent planning in preparation of highway programs."

#### SPECIAL MOTOR ROADS

"Whereas, the State Wide Planning Surveys have developed factual information relative to seriously congested traffic conditions in the regional areas adjacent to metropolitan centers, and,

Whereas, such traffic bottlenecks result in great economic loss and within the metropolitan areas seriously retard commerce, now therefore be it

Resolved: That this association recommends an early start toward providing special motor roads in such regional areas and metropolitan centers and where traffic

justifies between such regional areas and metropolitan centers of sufficient capacity to provide for the safe, uninterrupted and rapid flow of traffic.

Be it further resolved, that this association recommends that the several states and the federal government give early consideration to the development of a land policy that will make legally possible the acquisition of necessary rights of way for such special motor roads, with costs for land being amortized over a long period of years through rental or resale of land taken contiguous to the right of way proper, or other appropriate means."

#### ANTI-DIVERSION OF ROAD USER REVENUE

"Whereas, at present large sums of revenue derived from motor vehicle taxation are being devoted to other than highway use, and

Whereas, such methods of taxation are generally acknowledged to be unsound and unjust, and

Whereas, there is such an urgent demand for the use of all available funds for the needed development of the highway system, now therefore be it

Resolved: That this association urges all agencies concerned to make such adjustments to existing laws so as to stop and prevent this unjust diversion of highway funds."

#### EXPRESSION OF APPRECIATION

"Whereas, the Twenty-Fourth Annual Meeting of the American Association of State Highway Officials at Dallas, Texas, has been particularly successful, due in large measure to the interest manifested by His Excellency Governor James V. Allred, the splendid arrangements made by the Texas State Highway Department, the State-Wide Reception Committee, the Entertainment Committee, the cordial hospitality of the people of Dallas and the management and personnel of the Adolphus Hotel, and other individuals and organizations, and

Whereas, the very excellent program of entertainment provided has been most enjoyable for the delegates and their ladies, now therefore be it

Resolved: That this association hereby expresses its deep and sincere appreciation to His Excellency Governor James V. Allred, to the Texas State Highway Department, the management of the Adolphus Hotel and all other individuals and organizations who have contributed toward the success of this convention."

#### Motor Caravan

Following the convention those who desired to make a three-day tour of Texas highways were the guests of Texas on a trip through the southeastern part of the state. About 125 people representing 36 states loaded into the three big buses provided and the few private cars that made up the caravan. They left Dallas at 8:00 a. m. At about 10:30 a. m., "after crossing the Free State of Van Zandt," a stop was made at Tyler, the rosebush center of the world, where the Chamber of Commerce served light refreshments at the Country Club.

Through the town of Alto on U. S. 69 the caravan crossed the Kings Highway (El Camino Real), now State Highway No. 11. This road was opened by the Spaniards in 1714-15 from the site of Eagle Pass, Texas, to Natchitoches, Louisiana, and was the first definite route of travel through this part of Texas. Thirteen miles west of Alto is the original site of the mission "San Francisco de los Tejas," established by the Spaniards in 1690 but moved to a point near Alto in 1716. At 1:00 p. m. the caravan stopped at District 11 offices of the Texas State Highway Commission, where a sump-





*While Partaking of Coffee, Doughnuts, Cigars and Cigarettes at Tyler Country Club, Delegates Relaxed a Few Minutes.*

tuous game lunch was served. Four kinds of wild game were served along with two other barbecued meats, a salad, and 32 different kinds of cakes. Coffee and beer helped out. Such a feast I (and many others) had never gorged before.



*Picnic Luncheon Served by the Citizens of Lufkin, Texas, Included Quail, Squirrel, Opossum, Coon and Yams, Barbecued Chicken and Beef, Besides 32 Different Kinds of Cake.*

After the whistle called the departure, the caravan passed through the long leaf yellow pine belt of East Texas on the edge of what is known as the Big Thicket. At Woodville, a temporary stop, coffee and cookies were served while the Woodville High School Band rendered a few selections. Delegates will not forget the "baby in uniform."



*Woodville High School Band Welcomed the Cavalcade. Note the Cute Baby Drum Major.*

On south from Woodville we passed through Jefferson County where, within an area of 20 square miles, one-tenth of all the gasoline used in the United States is refined. The largest oil tank farms in the world are located here. Believe it or not, Jefferson County has two courthouses. One, a million dollar 12-story structure in Beaumont, and the other a new \$250,000 sub-

courthouse in Port Arthur. Before going to the hotels where we stayed for the night and where the Chamber of Commerce gave us a nice banquet, we drove out onto the new Port Arthur-Neches River bridge.

Next day, December 10, 1938, the caravan started on time, hugging the Gulf coast to Galveston. At Point Bolivar we boarded one of the Texas State Highway Department ferries which carried the motorcade across Galveston Bay into the city. All along the route the roads, bridges, and right-of-way was in first-class shape, showing evidence of preparation for an inspection. Particularly was this true of the ferry boats. Doughnuts and coffee helped pass the time as the delegates marveled at the shipping. A trip through the city, after landing, and over the new causeway was followed by a fast run to the San Jacinto battlefield, where the Texans won a decisive battle in about thirty minutes on April 21, 1836. History records no greater change in the fortunes of war than took place that day when fewer than 800 discouraged refugees, under Sam Houston's leadership, charged General Santa Anna's 1,500 trained men. A tall monument, said to be taller than the Washington monument, commemorates the battle. A lunch was served by the citizens of Houston in the famous San Jacinto Inn at the shore of Houston Ship Channel on the San Jacinto battlefield.



*Caravaneers Enjoy the Hospitality of the Citizens of Houston in the Famous San Jacinto Inn on the Battlefield Where Texas Won Her Independence From Mexico.*

Pushing on southwest from Houston, past sugar refineries and ricefields, the engineer-announcers in each bus explained the road types and bits of historical interest along the route. It was on this part of the trip that we rode over many miles of low cement content concrete paving. We pulled up for the night in the sub-tropical town of Corpus Christi. The town was named after the bay on which it is located. In 1519 Alvarez de Pineda gave this name to the bay in honor of a Catholic feast day on which it was discovered. Corpus Christi, a rapidly growing thriving city, treated the guests to a buffet supper, the likes of which I never saw or even heard before. Champagne flowed like water, Mexican and American foods and salads made the tables groan.

Next morning we headed west and south to Kingsville and the million-and-a-quarter-acre King Ranch. Guests were driven out onto the broad prairie where the daily tasks of branding, castrating, inoculating, and cropping were in progress. Here Congressman Kleberg, one of the owners of the ranch, explained something of the de-

*(Continued on page 60)*



## HEAVY-DUTY MOTOR GRADERS

62½ h.p. Diesel and 66½ h.p. Gasoline Engines



**POPULAR-PRICED MOTOR GRADER**  
with 45½ h.p. Gasoline Engine



**LOW-PRICED MOTOR GRADER**  
with 22½ h.p. Gasoline Engine



**ELEVATING GRADERS**  
with 42 and 48-Inch Carriers



**HAULING SCRAPERS**  
5, 6, 8, 10 and 12-Yard Sizes



# ADAMS *Road Machinery*

**COSTS LESS**



**IN THE LONG RUN**



**LEANING WHEEL GRADERS**  
with 6½, 7, 8, 10 and 12-Foot Blades

● **ECONOMY** in road machinery is measured by performance rather than by price. It is what you can do with a machine that first determines its value or earning capacity . . . Hundreds of owners will tell you that Adams machines are capable of a wider range of work, that they get into action quicker and are more practical in their operation than most other machines of their class. They do more work per dollar of operating cost and do it year after year at less upkeep expense than is common to other machines. That's why we say Adams road machinery "Costs Less in the Long Run."

Let your local Adams representative explain the operating advantages of the machines illustrated here or write for descriptive catalogs.

**LEANING WHEEL GRADERS**—Adams all-welded, monomember frame graders with high-lift, bank-cutting feature, are preferred by hundreds of highway officials and contractors because of their ease of operation and wide range of adjustments. Available with hand or power-operated controls.

**MOTOR GRADERS**—Adams offers three sizes of motor graders (shown on following page) designed to handle light, medium and heavy work. The medium-sized machine (with 45½ h.p. engine) is a new model—the first machine of its size and price class to have the high-lift, bank-cutting feature. Snow plows available for all models.

**ELEVATING GRADERS**—Because of patented features in frame, front axle and plow beam design, you can always bank on Adams Elevating Graders to move maximum yardage at the lowest possible cost under any conditions. They "take the ground" better and are more stable.

**HAULING SCRAPERS**—Cable-operated from tractor, Adams Hauling Scrapers are credited by many owners with loading quicker and dumping easier than any other scrapers on the market.

**J. D. ADAMS COMPANY**

INDIANAPOLIS, INDIANA, U.S.A.  
Branches and Representatives Throughout the United States

(Continued from page 57)



*Loading Out at Corpus Christi for the Last Day of a Glorious, Super-hospitable, Caravan Trip.*

velopment of this huge domain, of the development of the beef stock, of the development of the country and the coming of the railroad. Capt. King and later the elder Kleberg were the pioneering factors of what exists



*The Ranch House at King Ranch. The Simple, Unpretentious Interior Bespeaks the Characteristics of the Common Regular American.*

today. Over 500 men are on the payroll of the ranch.

After eating a chuck wagon barbecue as the guests of the ranch owners, the caravaneers headed for San Antonio.



*Chuck Wagon Barbecue Chow Line at King Ranch.*

The day was warm and everyone enjoyed the brief stop at Three Rivers. The arrival at San Antonio officially ended the traveling part of the trip. There still remained the Fellowship party and banquet in the eve-



*Cutting-out, Roping, Branding, and Inoculating Is All Part of the Day's Routine on King Ranch.*



*Spanish American Lady demonstrating to Caravaneers at San Antonio the Customary Method of Making Tortillos.*

ning as the guests of San Antonio. Not to be outdone in its hospitality, San Antonio provided Mexican entertainment with the sumptuous banquet.

This discussion would be incomplete without a commendatory word for those two wheelhorses, John Nations and R. J. Hawk, engineers of the Texas State Highway Department, who handled the baggage so smoothly and kept the caravan together and on time. Even a commendatory word for the caravaneers would be in order, as there was not a grouch or complainer in the crowd. For these pictures we are indebted to Maintenance Engineer Hodges. Texas was a most gracious host.

### Keep Headlights Up

**A**UTOMOBILE engineers may have some good reasons, from a point of economy, for putting the headlights of 1939 model cars, in the fenders. We believe, however, that they are too low there. Experience with thousands of miles of night driving convinces the writer that headlights should be placed back up to the height previously used. The principal reasons for this conviction are two-fold:

1. The lights are too low to properly illuminate directional and instructional road signs.
2. State highway departments have large investments in signing which have been placed to serve with headlights at the old heights. These investments should be protected.

So far as height of beam with respect to the eye is concerned, the old height was entirely satisfactory. There is still just as much glare from the fender headlights as there was in the higher position. The fender headlights are too low to properly illuminate highway signs. Rather than change all the signs, the car lights should be raised.



# HERE and THERE—1938



1. Combination Reinforced Concrete and Steel Bridge, 1900.58 ft. long, on U. S. Route 1 at Cheraw, South Carolina, Over the Big Pee Dee River. Contractors were Wannamaker and Wells, Inc., Orangeburg, South Carolina, and McMeekin Construction Company, Craig, Florida.

2. Stock Pile and Batching Plant of Contractor U. R. Price Co., on Indiana State Route 57, for Reinforced Concrete Paving Job.

3. Airplane Photo of Underpass Construction at Ames, Iowa, by Iowa State Highway Commission. Contractor: Ben Cole and Son, Ames, Iowa. Two railroad and One Highway Grade Separations Are Involved.

4. Joint and Dowel Bar Assembly Ready to Be Installed by Moellering Construction Company on Paving Job on U. S. Route 27 Near Waterloo, Indiana.

5. Widening 16.7 Miles of a 1922 Model 16-Foot Concrete Pavement to 22 Feet and Resurfacing With Sheet Asphalt and Hot Binder, Northwest of Columbia, South Carolina, on Route 76. The Jaeger Spreader and Finisher Traveled 8 Feet Per Minute Spreading Hot Sheet Asphalt. Contractor: The Wesco Company, Chattanooga, Tenn.

# YOU SAVE WORK FOR IT ... AND IT SAVES



↑  
Doniphan County, Kansas, hooks its "Caterpillar" Diesel D7 Tractor onto a LaPlant-Choate C-5 rear-dump scraper and puts the outfit to straightening, cutting and filling. Working 8 hours a day, fuel costs only \$1.60 . . . 2½ gallons an hour, at 64¢ a gallon!

→  
Here is an example of "Caterpillar" Diesel maintenance-economy. This machine, owned by Early County, Georgia, has done a lot of hard work . . . 10,000 hours of it! But through proper lubrication and care, Early County finds that repairs cost only 10¢ an hour! Fuel-economy is on a similar scale. To help build this farm-to-market road, the tractor pulls a 6-yard LeTourneau scraper and uses only 2½ gallons of Diesel fuel an hour. Tough red clay here. But 40½ cubic yards are being moved every hour on a 750-foot haul!





# MONEY FOR YOU



Upson County, Georgia, wanted to rebuild one of its highways. That meant its "Caterpillar" Diesel D7 Tractor could make another definite contribution to its already large savings. Using only  $2\frac{1}{2}$  gallons of 9-cent fuel an hour, it is here lugging a Killefer ripper so the scrapers can come in. This county, in one year, has saved \$3500 through "Caterpillar" Diesel power. There's a tip for other counties—and contractors too!



Here is a "Caterpillar" Diesel D7 Tractor and a No. 66 "Caterpillar" Grader pulling ditches and shoulders for Geneva County, Alabama. Working 10 hours a day, this machine consumes only  $2\frac{3}{10}$  gallons of 9-cent fuel an hour. You get an idea of what Geneva County thinks of "Caterpillar" Diesels when you know its line-up of equipment . . . 3 tractors, 3 blade graders, and 2 "Caterpillar" Diesel Auto Patrols!

No matter what road work you hand a "Caterpillar" Diesel Tractor—pulling a grader, lugging a ripper, hauling a scraper, or towing a wagon—you get the *same* type of fuel-economy, power, and sure-footed traction!

In fact, the efficiency, versatility and economy of this machine are so worth while that you're apt to save up all your jobs for it!

- And that, after all, is the wise thing to do. For a "Caterpillar" Diesel Tractor can pay for itself from *two* different angles. The first day you put it to work, it starts to *wipe out* its purchase-price through savings on fuel . . . and savings on maintenance!

- But in order to speed up the process, you can let it handle a variety of duties—and *save* you the added expense of buying, operating

and maintaining specialized equipment that works only part-time!

A few of the ways that can be done are shown in these pictures. Look them over. Study them carefully. And notice the fuel-economies and maintenance-savings these counties get with "Caterpillar" Diesels! •

## CATERPILLAR

TRACTOR CO., PEORIA, ILL.

DIESEL ENGINES  
TRACK-TYPE TRACTORS • ROAD MACHINERY

# STATE HIGHWAY CONSTRUCTION

*Reports from Highway Officials Showing Mileage Completed and Expenditures in 1938 and Probable Mileage and Expenditures in 1939*

## NEW ENGLAND DIVISION

### Maine

State highway construction completed last year totaled 96 miles, the types being as follows:

#### STATE HIGHWAY CONSTRUCTION COMPLETED IN 1938

Type	Miles
Gravel .....	54
Bituminous types .....	19
Concrete .....	12
Bridges—number .....	9
Grade separations—number .....	2

The uncompleted construction carried over to the present year was:

#### UNCOMPLETED CONSTRUCTION CARRIED OVER TO 1939

Type	Miles
Gravel .....	13
Bituminous types .....	6
Concrete .....	4
Bridges—number .....	7
Grade separations—number .....	3

The construction program for 1939 has not yet been determined.

L. D. Barrows, Augusta, Me., is state highway engineer.

### New Hampshire

It is estimated that 70 miles of state highway were completed in 1938 at an expenditure of approximately \$1,870,000.

Tentative estimates for 1939 call for the construction of about 40 miles at an approximate expenditure of \$755,000.

### Vermont

The following tables give some details of the state highway construction in 1938:

#### WORK STARTED IN 1938 AND COMPLETED IN 1938—STATE HIGHWAY CONSTRUCTION COMPLETED IN 1938

Type	Miles	Approximate Cost
Graded and drained.....	2.8	\$ 72,100
Gravel .....	0.6	27,500
Bituminous types .....	11.2	237,200
Concrete .....	0.6	87,850
Bridges, number .....	16	151,550
Grade separations—number.....	1	23,800
R. R. crossing signals.....	4	9,600
Landscaping .....	3.5	7,500

#### PROJECTS STARTED IN 1937 AND CARRIED OVER INTO 1938—UNCOMPLETED CONSTRUCTION CARRIED OVER TO 1938

Type	Miles	Approximate Cost
Graded and drained.....	9.0	\$ 36,500
Bituminous types .....	55.0	1,641,000
Concrete .....	7.0	362,000
Bridges—number .....	13	177,500
Grade separations—number .....	2	116,250
R. R. crossing signals.....	2	6,000
Landscaping .....	11.7	14,000

#### PROJECTS THAT STARTED IN 1938 AND WHICH WILL BE CARRIED OVER INTO 1939

Type	Miles	Cost Approximate
Graded and drained .....	0.8	\$ 17,000
Bituminous types .....	25.0	769,300
Concrete .....	1.0	34,952
Bridges—number .....	30	341,200
Overpasses—number .....	1	20,048
R. R. crossing signals.....	3	8,750

The constructive program for 1939 has not yet been decided as it depends on the appropriations of the state legislature.

Hubert E. Sargent, Montpelier, Vt., is state highway commissioner.

### Rhode Island

The following tabulations show the construction completed in 1938 and the uncompleted construction carried over to 1939:

#### STATE HIGHWAY CONSTRUCTION COMPLETED IN 1938

Type	Miles	Approximate Cost
Bituminous types .....	4.56	\$235,000
Concrete .....	0.36	45,000
Bridges, number .....	7	87,500
Grade separations, number .....	3	224,000
Dual type—R. C. concrete and bit. mac....	6.88	450,000
Dual type—bit. mac. and bit. conc.....	4.37	275,000
Bit. surface on concrete base.....	2.58	325,000

#### UNCOMPLETED CONSTRUCTION CARRIED OVER TO 1939

Type	Miles	Cost
Bituminous types .....	5.88	205,000
Grade separations, number.....	4	233,000
Dual type—R. C. concrete and bit. mac....	1.52	155,000
Bit. surface on concrete base.....	0.61	60,000

No definite construction program has as yet been prepared for 1939. The commission is awaiting appropriations of state legislature.

John V. Kelly, Providence, R. I., is state highway engineer.

### Connecticut

Figures for fiscal year ending June 30, 1938, show the following:

Miles constructed and reconstructed state highways, 67.35; town highways, 116.23; also many miles minor improvement town highways. Total expenditure of funds including construction maintenance and administration of roads and bridges was \$19,258,919.

Estimated expenditures fiscal year ending June 30, 1939, are \$25,000,000.

## MIDDLE ATLANTIC DIVISION

### New Jersey

In 1938 19.4 miles of paving and 21.6 miles of widening on state highway were completed. The construction expenditure on completed and uncompleted projects was \$8,413,792.



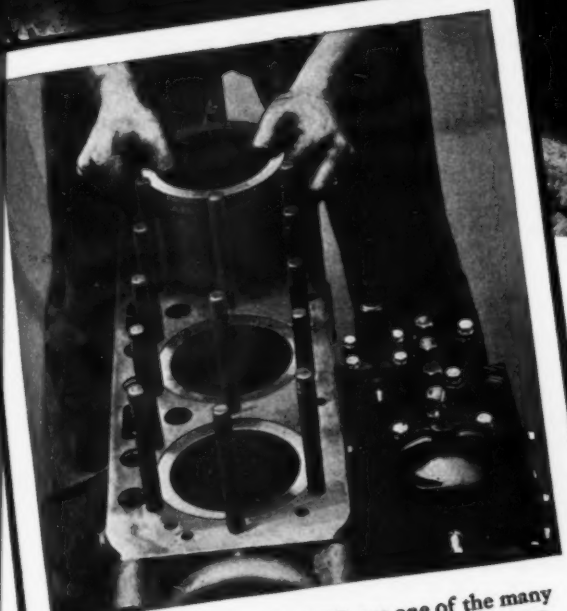
# INTERNATIONAL Power...

## Engineered for Plus Performance



*International TracTracTors have a great reputation for their fast, flexible operation under tough conditions. This is the Model TD-40 Diesel doing its stuff on an earth-moving job.*

• There are many sound and practical reasons back of the wide preference for International Industrial Power. When you buy International you buy low-cost maintenance, long life, and performance and economy that produce profit on the job . . . the result of the skilled engineering that goes into every detail of International Harvester *quality* products. There are TracTracTors (crawlers) and wheel tractors for gasoline and Diesel operation, and 11 models of power units, gasoline, Diesel, and gas, ranging up to 110 max. h.p., in the International line. Check into these tractors and engines and see for yourself how they fit into your operations. The nearby International industrial power dealer or Company-owned branch will demonstrate the efficiency and economy of International Power any time you say.



**REPLACEABLE CYLINDERS** are one of the many money-saving features engineered into International Industrial Tractors and Power Units. Cylinders may be removed and replaced with new cylinders of the same size. These new cylinders, with new pistons, fully renew the original engine with new compression and efficiency. This feature saves International owners the cost of expensive re-boring operations.

### INTERNATIONAL HARVESTER COMPANY

(INCORPORATED)  
180 North Michigan Avenue

Chicago, Illinois



• International Power Units are readily adapted to a wide variety of work. This is a Model PD-80 Diesel operating a suction dredge, producing 100 yards of sand and gravel a day.

# INTERNATIONAL INDUSTRIAL POWER

The construction program for 1939 has not been decided as the amount of work is depended on action of the state legislature.

James Logan, Trenton, N. J., is state highway engineer.

## EAST NORTH CENTRAL DIVISION

### Ohio

During 1938 the state highway department awarded 332 contracts which covered 2,129 miles of highway and represented an estimated expenditure of \$18,050,169.

The tentative program for 1939 involves an expenditure of \$15,000,000 which includes state and federal funds.

### Indiana

The following tables show the state highway construction completed in 1938 and the uncompleted construction carried over to 1939:

#### STATE HIGHWAY CONSTRUCTION COMPLETED IN 1938

Type	Miles
Graded and drained.....	14.186
Gravel and stone.....	9.519
Bituminous types .....	51.849
Concrete .....	40.068
Stabilization .....	
Bridges, number .....	84
Grade separations, number.....	16

#### UNCOMPLETED CONSTRUCTION CARRIED OVER TO 1939

Type	Miles
Graded and drained.....	216
Gravel .....	
Bituminous types .....	
Concrete .....	
Stabilization .....	
Bridges, number .....	30
Grade separations, number.....	2

The construction proposed for 1939 calls for an approximate expenditure of \$12,000,000. Details of this work follow:

#### PROPOSED CONSTRUCTION FOR 1939

Type	Approximate Cost
Graded and drained.....	\$ 540,841
Bridges .....	1,285,364
Roadside improvement .....	299,612
Paving—high and low type.....	9,949,183

M. B. Keefe, Indianapolis, Ind., is chief engineer state highway commission.

### Illinois

State highway construction costing approximately \$21,500,000 was completed in 1938. Types and mileages are given in the accompanying tabulation:

#### STATE HIGHWAY CONSTRUCTION COMPLETED IN 1938

Type	Miles
Graded and drained .....	131.16
Gravel .....	263.18
Bituminous types .....	171.09
Concrete .....	194.44
Bridges—number .....	86
Grade separations—number .....	16

Uncompleted construction of an approximate cost of \$11,594,634 was carried over to 1939. This is as follows:

#### UNCOMPLETED CONSTRUCTION CARRIED OVER TO 1939\*

Type	Miles
Graded and drained.....	36.51
Gravel .....	51.07
Bituminous types .....	10.76

Concrete .....	91.81
Bridges—number .....	42
Grade separations—number .....	22
Highway grade separations.....	3

\*These figures include work pending award.

For 1939 there is available for new construction \$6,405,000 carried over and unobligated from 1938, and in addition to this figure there is approximately \$15,500,000 available for 1939 construction that has not been programmed, a total of approximately \$22,000,000.

Ernst Lieberman, Springfield, Ill., is chief highway engineer.

### Wisconsin

The following tabulation gives some details of the 1938 construction under the direction of the state highway commission:

#### STATE HIGHWAY CONSTRUCTION COMPLETED IN 1938\*

Type	Miles	Approximate Cost
Graded and drained.....	310	\$3,640,000
Gravel .....	247	1,587,000
Bituminous types .....	506	913,000
Concrete .....	91	2,462,000
Grade separations—number 19.....		2,917,000
Miscellaneous .....		600,000

\*Figures shown are contracts awarded during calendar year.

Nearly 500 miles of Wisconsin's highway will be improved during 1939. The projects are listed as being "programmed to date," subject to possible additions or subtractions during the year as conditions and finances determine. Included in the program on state highway routes will be 130 miles of concrete pavement at an estimated cost of \$3,695,000, gravel surfacing on 168 miles at an estimated cost of \$950,000, grading and draining of 130 miles of highway at a total cost of \$2,836,000, and bridges and grade separation projects estimated to cost \$1,157,000.

Total estimated cost of these state highway projects is \$8,750,000, while an additional program of \$1,500,000 for construction off the state highway routes calls for 24 bridges at an estimated cost of \$550,000, four grade separations at a cost of \$675,000, and six miles of pavement to cost \$325,000.

Generally, these project not on state routes are on county trunks and city streets.

E. L. Roettiger, Madison, Wis., is state highway engineer.

### Michigan

During 1938 350 miles of road, 14 bridges and 8 grade separations were constructed. The total cost was \$10,700,000. The present outlook is for a 20 per cent in mileage constructed and expenditures during 1939.

Murray D. Van Wagoner, Lansing, Mich., is state highway commissioner.

## WEST NORTH CENTRAL DIVISION

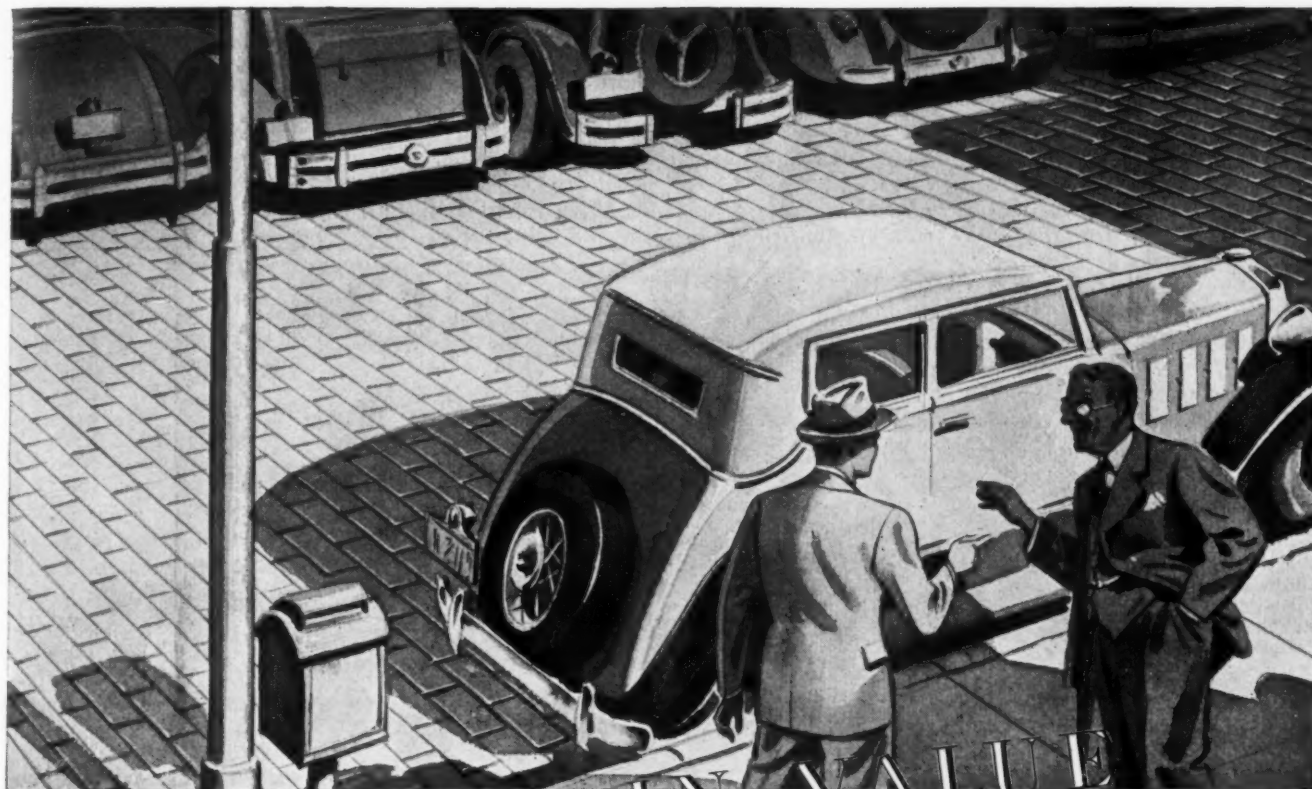
### Iowa

Construction completed in 1938 on the state primary road system was as follows: Graded, 179 miles; graveled surface, 97 miles; paved 292 miles; bituminous surfaced, 85 miles. The total construction expenditure was approximately \$13,000,000.

The probable construction for 1939 is as follows:

Paving, 150 miles; grading, 165 miles; gravel, 75





TRADE-IN VALUE

## ONLY ONE PAVEMENT HAS ANY



### BRICKBATS WIN BOUQUETS AT JACKSONVILLE AIRPORT

As you see here, (Jacksonville, Fla.) uses brickbats for paving around its municipal airport buildings. They were leftovers when brick streets that had been in service more than 25 years were relaid. The white filler is sand. City Engineer W. E. Shedd has been a pioneer in this work long before the present program of government work relief. During the last two years, Jacksonville WPA projects have included 180,000 square yards of this work.

● Big and little towns all over the country have been trading in their veteran brick pavements and, for a nominal cost, getting brand-new 1939 model brick pavements with the latest improvements.

Many of these brick pavements were upwards of 35 years old, and the brick had a 75% or greater trade-in value. Salvage value, some call it.

But the point is, it must be a brick pavement to get this trade-in allowance. No other modern pavement has it.

A material that can give two-score years of service in a street pavement and then be largely reusable has what present day traffic needs.

Brick has the lowest upkeep and longest life. Its high trade-in value is a "plus" that no other pavement can offer. National Paving Brick Association, National Press Building, Washington, D. C.

# BRICK

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NATIONAL PAVING BRICK  
ASSOCIATION  
COLUMBUS, OHIO—FEB. 2-3

FOR NEW CONSTRUCTION OR RESURFACE JOBS

miles; bituminous construction, 75 miles. Probable expenditure is \$12,000,000.

### Missouri

Contracts were awarded in 1938 covering reconditioning, reconstruction and new construction amounting to approximately \$5,800,000. The work covered 1,853 miles of highway.

The estimates for the 1939 construction program are not yet available.

### North Dakota

A total of 300 miles stabilization costing approximately \$1,163,080 was one of the principal items of the state highway construction completed in 1938. The following table gives some details of last year's work:

#### STATE HIGHWAY CONSTRUCTION COMPLETED IN 1938

Type	Miles	Approximate Cost
Graded and drained	184	\$ 828,000
Gravel (feeder roads)	20	34,000
Bituminous types	547	1,033,000
Concrete	1	103,000
Stabilization	300	1,163,080
Bridges—number	6	89,000
Grade separations—number	4	383,000
Culverts	48	74,000

The uncompleted construction carried over to the present year is as follows:

#### UNCOMPLETED CONSTRUCTION CARRIED OVER TO 1938

Type	Miles	Approximate Cost
Graded and drained	62	\$279,000
Gravel (feeder roads)	31	53,000
Bituminous types	41	77,450
Stabilization	51	197,710
Bridges—number	3	130,000
Grade separations—number	3	523,000

The proposed highway construction program for 1939 calls for an approximate expenditure of \$4,700,000 and the improvement of 580 miles of road. In addition four grade separations costing \$600,000 will be undertaken.

Z. E. Sevison, Bismarck, N. Dak., is state highway engineer.

### South Dakota

A total of 281 miles of stabilization was completed in 1938 at an approximate cost of \$719,000 and 220 miles of uncompleted stabilization were carried over to 1939. The following tabulation gives some details of the 1938 work:

#### STATE HIGHWAY CONSTRUCTION COMPLETED IN 1938

Type	Miles	Approximate Cost
Graded nad drained	325	\$1,511,694
Gravel	58	83,941
Bituminous types	366	1,124,504
Concrete	11	325,600
Stabilization	281	719,019
Bridges—number	22	502,189
Grade separations—number	3	89,298
Guard rail		51,014
R. R. crossing signals	26	91,957
Roadside improvement		59,923

The uncompleted construction carried over to 1939 included the following:

#### UNCOMPLETED CONSTRUCTION CARRIED OVER TO 1939

Type	Miles	Approximate Cost
Graded and drained	104	\$596,064
Gravel	1	1,635
Bituminous types	70	252,217
Concrete	10	279,696

Stabilization	220	710,663
Bridges—number	7	158,222
Grade separations—number		
Guard rail		23,210
R. R. crossing signals	2	5,569
Roadside improvement		31,692

Included in the proposed construction program for 1939 are 300 miles of bituminous types and 200 miles of graded and drained roads. The program includes the following:

#### PROPOSED CONSTRUCTION FOR 1939

Type	Miles	Approximate Cost
Graded and drained	200	\$1,200,000
Bituminous types	300	1,243,000
Concrete	26	650,000
Stabilization	70	260,000
Bridges—number	15	300,000
Grade separations—number	7	240,000
Guard rail		25,000
R. R. crossing signals	30	100,000
Roadside improvement	40	37,000

It should be noted that the figures for the proposed construction are tentative and subject to change.

F. H. Schrader, Pierre, S. Dak., is state highway engineer.

### Nebraska

Statistics have not been worked up in shape to give complete information for 1938 completed construction and uncompleted work carried over to 1939. However, a summary of the 1938 construction obligations shows that construction obligations total approximately \$8,000,000 covering 613 miles of new grading, 408 miles of new gravel, 383 miles of new paving, all of which includes 7 grade separations, 149 bridges, 13 armored crossings, 13 roadside improvement projects, 12 sets reflectorized railroad crossing signs, and one set traffic signals.

The 1939 construction program is dependent on appropriations to be made by the legislature which convenes in January and on the action of the federal congress.

A. C. Tilley, Lincoln, Neb., is state engineer.

### Kansas

The state highway commission completed 14.81 miles of highways of all types and 76 bridges during 1938. The total cost was \$9,700,000.

The probable expenditures for 1939 will be \$8,000,000.

A. B. Nuss, Topeka, Kan., is state highway engineer.

## SOUTH ATLANTIC DIVISION

### Delaware

The construction expenditure in 1938 was \$1,900,000. The work included 15 miles high type pavement; 45 miles high type pavement widening; 15 miles low type pavement; and six major bridges.

Approximately \$2,000,000 will be expended in 1939 for construction, the probable mileage being: 20 miles high type; 40 miles widening high type; 30 miles low type. In addition there will be two grade crossing eliminations.

W. W. Mack, Dover, Del., is chief engineer state highway department.

### Maryland

In 1938 90 miles of state highway were completed and 119 miles were under construction at the end of the year. The estimated cost was \$6,903,444.



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General Supply Co. of Canada, Ltd., Tyne Machinery Company, Vancouver, B. C.			

The proposed construction program for 1939 calls for the construction of 165 miles of highway. The amount at present available for construction is \$5,856,700.

E. M. Reindollar, Baltimore, Md., is assistant chief engineer.

### Virginia

A total of 412 miles of highway construction on the primary system was completed in 1938. Detailed cost for the calendar year is not available, as this information is kept by fiscal year, July 1-June 30. The following table shows the mileage by type completed last year:

MILEAGE COMPLETED IN 1938—PRIMARY SYSTEM	
Types	Miles
Shale and local material .....	14
Traffic bound gravel .....	8
Surface treated soil and gravel .....	78
Traffic bound macadam .....	32
Surface treated macadam .....	124
Bituminous surface course .....	2
Sheet asphalt .....	31
Concrete .....	123

The uncompleted contracts on the primary system carried over to 1939 are estimated to cost approximately \$10,270,000, they include the following:

UNCOMPLETED CONTRACTS CARRIED OVER TO 1939—PRIMARY SYSTEM	
Types	Miles
Grading .....	3
Shale and local material .....	41
Traffic bound gravel .....	7
Surface treated soil and gravel .....	48
Traffic bound macadam .....	48
Surface treated macadam .....	159
Sheet asphalt .....	7
Concrete .....	20

52 bridges; 7 grade crossings; 10 flashing signals.

Details of the 1939 construction program are not available at this writing. However, it is estimated that approximately \$25,000,000 will be expended this year on the primary and secondary systems.

C. S. Mullin, Richmond, Va., is chief engineer, state highway department.

### North Carolina

State highway construction costing approximately \$9,215,000 was completed last year. The accompanying table gives details of this work:

STATE HIGHWAY CONSTRUCTION COMPLETED IN 1938		
Type	Miles	Approximate Cost
Graded and drained .....	325	\$2,275,000
Topsoil and sand clay .....	80	175,000
Gravel and crushed stone .....	120	625,000
Bituminous types (surface treatment) .....	265	1,115,000
Concrete .....	80	2,400,000
Sand asphalt .....	30	325,000
Bridges and grade separations—number .....	86	2,300,000

The uncompleted construction carried over to the present year is as follows:

UNCOMPLETED CONSTRUCTION CARRIED OVER TO 1939		
Type	Miles	Approximate Cost
Graded and drained .....	300	\$2,100,000
Topsoil and sand clay .....	135	300,000
Gravel and crushed stone .....	115	600,000
Bituminous types (surface treatment) .....	260	1,100,000
Concrete .....	50	1,510,000
Sand asphalt .....	35	385,000
Bridges and grade separations—number .....	56	1,120,000

The construction program for the present year calls for an approximate expenditure of \$8,300,000 and includes the following:

PROPOSED CONSTRUCTION FOR 1939		
Type	Miles	Approximate Cost
Graded and drained .....	255	\$1,680,000
Topsoil and sand clay .....	270	590,000
Gravel and crushed stone .....	155	790,000
Bituminous types (surface treatment) .....	340	1,285,000
Concrete .....	80	1,980,000
Sand asphalt .....	60	595,000
Bridges and grade separation—number .....	135	1,380,000

W. Vance Baise, Raleigh, N. C., is state highway engineer.

### Georgia

The state highway department let contracts in 1938 for the following work: Grading, 320 miles; paving, 235 miles; miscellaneous types, 94 miles; grade crossing eliminations, 24. The estimated cost of the above work is \$8,800,000.

It is estimated that the state will have \$17,500,000 for road construction in 1939. The mileage and type have not yet been determined.

W. B. Brantley, Atlanta, Ga., is state highway engineer.

## EAST SOUTH CENTRAL DIVISION

### Kentucky

The following tabulation shows the approximate mileage of state highway constructed during 1938:

	Miles
Earth, improved .....	105
Gravel, untreated, including crushed stone .....	570
Gravel, treated .....	48
Low cost bituminous mix .....	131
Hard Surface—	
Asphalt .....	25
Concrete .....	100
Other hard surface .....	24

It is expected that approximately \$17,400,000 will be available for highways in 1939. Of this total \$8,500,000 will be construction, \$4,500,000 for maintenance and \$4,400,000 for other highway purposes.

The probable construction program for 1939 is as follows:

	Miles	Amount
Grading .....	100	\$1,500,000
Gravel or crushed stone .....	125	1,200,000
Oil treatment .....	300	2,000,000
Paving, high type .....	60	2,000,000
Paving, low type .....	75	1,300,000
Bridges .....	50	500,000

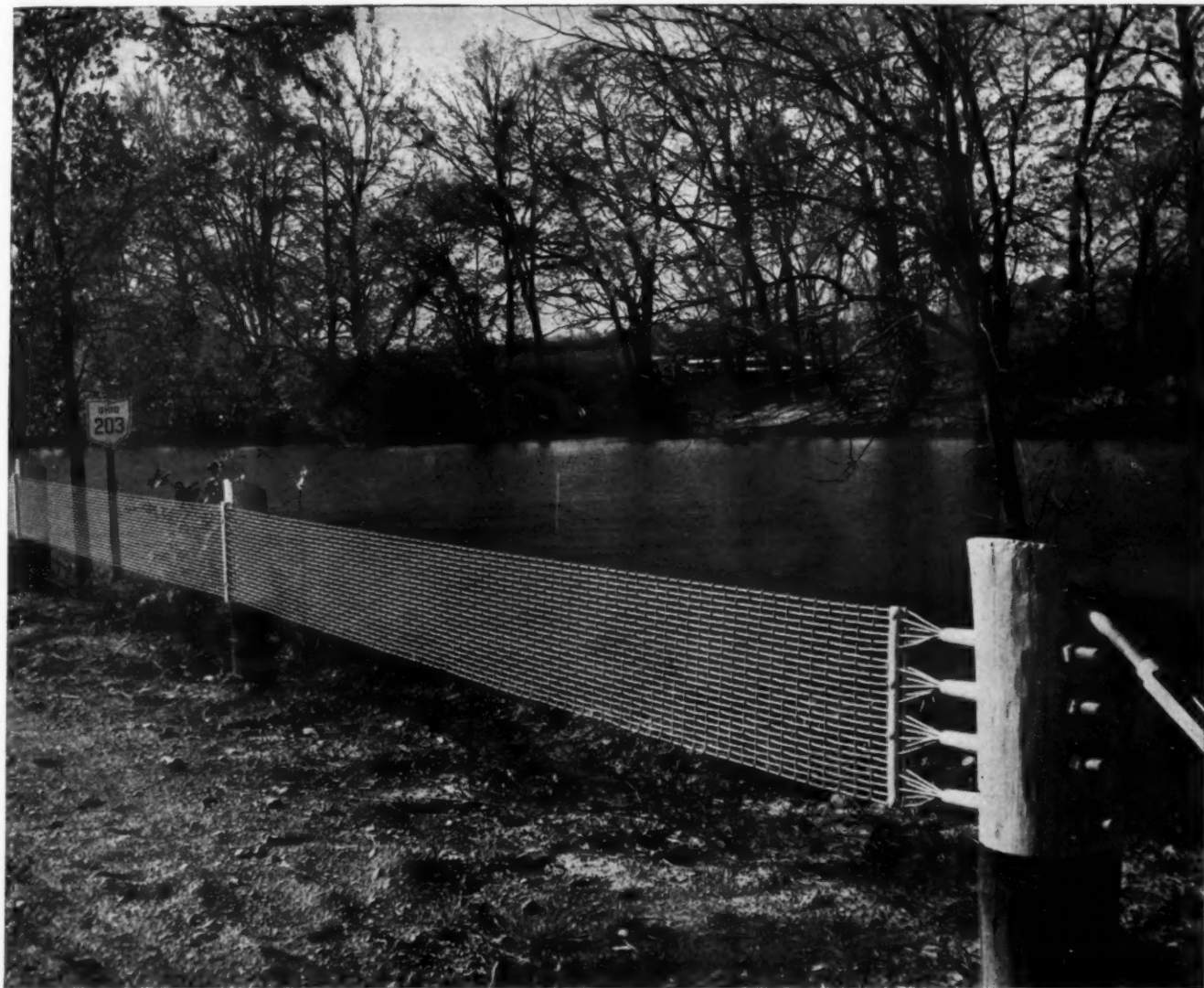
T. H. Cutler, Frankfort, Ky., is state highway engineer.

### Tennessee

During 1938 565 miles of state highway were completed at a cost of \$7,900,000. Details of the work are shown in the table below:

STATE HIGHWAY CONSTRUCTION COMPLETED IN 1938		
Type	Miles	Approximate Cost
Graded and drained and gravel .....	102	\$ 857,000
Bituminous types .....	56	1,747,743
Concrete .....	68	2,178,664
Stabilization .....		
Bridge (number) .....	54	940,000
Grade separations (number) .....	10	625,000
Asphalt surfacing (by maintenance dept.) ..	275	1,500,000





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PITTSBURGH STEEL COMPANY, GRANT BLDG., PITTSBURGH, PA.

The following table shows the uncompleted construction carried over to the present year:

UNCOMPLETED CONSTRUCTION CARRIED OVER  
TO 1939

Type	Miles	Approximate Cost
Graded, drained and gravel.....	81	\$1,058,394
Bituminous types .....	10	555,592
Concrete .....	31	1,449,235
Stabilization .....	..	..
Bridges (number) .....	70	1,086,671
Grade separations (number).....	3	133,355

The estimated 1939 program calls for 277 miles of highway improvement costing \$9,120,000. This includes all projects now under construction, several of which are almost complete but not yet accepted by the state highway department.

### Alabama

The following is the highway program forecast for 1938-1939.

The anticipated revenues for the state highway department during the fiscal year 1938-1939 are as follows:

Motor fuel tax .....	\$ 7,000,000
Auto license .....	2,850,000
Motor bus and carrier.....	175,000
County aid .....	2,050,000
Federal aid .....	5,700,000
Total .....	\$17,775,000

The estimated disbursements for the fiscal year 1938-1939 according to programs are as follows:

Fixed charges .....	\$ 3,610,000
Construction .....	11,150,000
Maintenance .....	2,000,000
Administration supervision .....	450,000
Equipment .....	200,000
Miscellaneous .....	365,000
Total .....	\$17,775,000

Total .....

It is believed that some 1,200 miles of road will receive improvement of total construction or re-construction. This 1,200 miles of highway improvement will be in the greatest percentage paved roads.

In order to reveal the activities for the year immediately past 1937-1938, the following tabulations will indicate the accomplishments of the state highway department. Expenditures for 1937-1938 were as follows:

Fixed charges including retirements.....	\$ 3,927,000
Construction .....	10,200,000
Maintenance .....	2,000,000
Administration supervision .....	475,000
Equipment .....	285,000
Miscellaneous .....	73,000
Total .....	\$16,960,000

MILES OF ROAD BY TYPES COMPLETED FISCAL  
YEAR 1937-1938 AND UNDER CONSTRUCTION

Status	Bridges	Bit.	Cons.	Gravel	Total
Completed .....	0.904	910.964	1.350	12.558	925.776
Under construction.....	3.001	1,095.395	3.495	69.077	1,170.968
Total .....	3.905	2,006.359	4.845	81.635	2,096.744

MILES OF ROAD BY TYPES COMPLETED JAN. 15, 1935,  
TO SEPT. 30, 1938, AND UNDER CONSTRUCTION

Status	Bridges	Gr. and Dr.	Bit.	Conc.	Gravel, Improve- etc. ment	Total
Completed .....	4,540	79.246	1,472.568	32.991	165.893	7.880
Under const.....	3.001	.....	1,095.395	3.495	69.077	.....
Total .....	7,541	79.246	2,567.963	36.486	234.970	7.880

C. J. Sherlock, Jr., Montgomery, Ala., is chief engineer, state highway department.

### Mississippi

The total expenditure for state highway construction completed in 1938 was \$17,154,408. Details of the work were as follows:

STATE HIGHWAY CONSTRUCTION COMPLETED  
IN 1938

Type	Miles	Approximate Cost
Graded and drained.....	422	\$5,915,467
Asphalt (high type) .....	34	676,575
Concrete .....	324	7,778,194
Bridges—number, 191 .....	5.979	2,584,170
Grade separations—number, 7.....	(*)	(*)
Miscellaneous construction .....	..	400,000

\*Included in roadways and bridges.

The approximate cost of uncompleted construction carried over to this year was \$27,652,280. This work included the following:

UNCOMPLETED CONSTRUCTION CARRIED OVER  
TO 1939

Type	Miles	Approximate Cost
Graded and drained.....	554	\$ 9,174,316
Asphalt (high type) .....	66	1,296,926
Sand asphalt .....	42	658,413
Bituminous types .....	101	1,210,538
Concrete .....	482	11,049,098
Bridges—number, 257 .....	9.342	4,262,986
Grade separations—number, 11.....	..	(*)

\*Included in roadways and bridges.

The proposed construction program for 1939 and 1940 calls for an expenditure of \$30,000,000.

R. A. Harris, Jackson, Miss., is chief engineer, state highway department.

### WEST SOUTH CENTRAL DIVISION

#### Arkansas

During the 1938 calendar year, contract awards for road and bridge projects aggregated \$5,524,443 and involved the following types of work:

Grading and minor drainage structures.....	215.7 miles
Gravel surfacing .....	39.7 miles
Base courses for bituminous surfacing.....	234.9 miles
Bituminous surfacing .....	249.6 miles
Portland cement concrete pavement.....	40.6 miles
Bridge structures .....	4,120.0 lin. ft.
Railroad separation structures.....	8

For the similar period \$3,020,544 was expended in the administration of the department and the maintenance of the state highway system and \$8,655,307 for debt service consisting of interest on outstanding obligations and the retirement of maturities.

Construction funds available for the 1939 calendar year consist of regular federal aid in the amount of \$1,698,000, secondary or farm-to-market road funds in the amount of \$254,000 and railroad-highway grade crossing separation and protection funds in the amount of \$346,000. These funds are the federal apportionments for the 1940 fiscal year beginning July 1, 1939, and require matching by the state except in the instance of grade crossing separation and protection funds. The state is now making arrangements to absorb the regular federal aid through toll bridge reimbursement but a method of utilizing the secondary road fund has not yet been perfected. Small balances of previous apportionments of federal funds will also be placed under award during the coming interim.

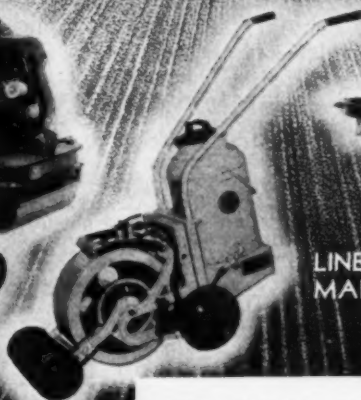
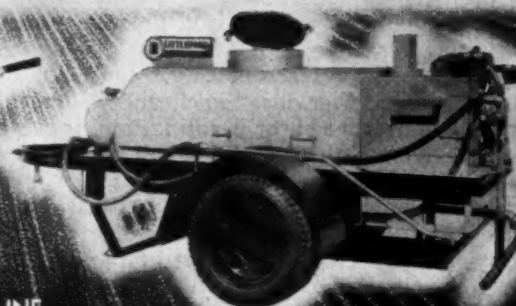
W. W. Zass, Little Rock, Ark., chief engineer, state highway commission.



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### Louisiana

During the year 1938 there were under construction in Louisiana, highway contracts amounting to \$24,000,000, of which \$8,000,000 represents new work started during the year and \$16,000,000 was for work carried over from 1937.

This work was financed by the sale of bonds authorized by the legislature of 1936 and by the usual federal and state revenues.

With the exception of a few unpaved sections which are rapidly being eliminated, the primary network of the state highways is now surfaced. Thus, funds available during the year have, to a large extent, been used for much needed betterments such as revision of alignment, grade reduction, increased capacity, elimination of hazards and improved surfacing.

Hardly of less importance is the added stimulus given to the expansion of the secondary network of aggregate type surfaced highways, generally known as farm-to-market roads. The development of these vital roads has been made possible by an annual Federal Aid Fund and by the sale of bonds authorized by the legislature of 1936. During the year 425 miles, at a contract cost of \$3,300,000 were under construction, of which 136 miles had been opened to the public by the beginning of 1939.

The outstanding bridge project of the year is, of course, the \$9,500,000 combined highway and railway structure spanning the Mississippi River at Baton Rouge. Graded and steel approaches are practically complete; the difficult deep foundation work is proceeding satisfactorily and erection of steel for the main span is expected to begin early in 1939. Other structures, while smaller, nevertheless merit attention as important parts of the trunk line highways. Particularly worthy of mention are those over the New Basin Canal, Tangipahoa River, Bayou Lafourche and Vermilion Bayou.

Grade separation, as a means of increasing highway capacity as well as decreasing hazards, has been considered of paramount importance and grade crossing elimination structures have been completed during the year on the trunk highways at Oil City, Mansfield, Benton, Pollock, Jennings, Pineville, Slidell and Winnfield.

Roadside improvement, or beautification, is recognized as desirable from both the aesthetic and economic viewpoints and is being practiced wherever funds are available after the immediate needs for expansion and improvement are taken care of and on some entirely new projects is being included as a part of the development.

The following tabulations give some details of the work in 1938 and proposed work for 1939:

	Completed 1938	Forward to 1939	New York—1939
Concrete .....	92 \$3,190,000.00	72 \$ 3,192,000.00	116 \$ 4,870,000.00
Surface treatment .....	10 156,000.00	24 350,000.00	...
Gravel .....	146 815,000.00	281 2,444,000.00	400 3,050,000.00
Grading .....	11 154,000.00	78 744,000.00	51 912,500.00
Bridges (11) .....	6 568,000.00	(6) 3 893,000.00	5 1,128,000.00
Grade separations .....	(8) 4 828,000.00	(7) 3 666,000.00	3 678,000.00
Roadside improvements .....	...	(2) 7 64,000.00	8 100,000.00
	269 \$5,711,000.00	468 \$18,353,000.00	583 \$10,738,500.00
Maintenance construction .....	650,000.00	610,000.00	
	\$6,361,000.00	\$18,963,000.00	

Funds Available 1939—	
F. A. (regular) .....	\$1,791,000.00
F. A. (secondary) .....	358,000.00
F. A. (grade separations) .....	777,000.00
Total F. A. ....	\$ 2,926,000.00
Motor tax .....	4,700,000.00
Bond .....	8,363,000.00
Total funds .....	\$15,989,000.00

### Disbursements—1939—

Construction .....	\$10,739,000.00
Maintenance .....	3,500,000.00
Equipment .....	250,000.00
Extraordinary maintenance .....	1,500,000.00
	\$15,989,000.00

### Gasoline Tax (Anticipated Revenues (4c) 1939; \$9,200,000.00)—

To L. H. C. ....	4c
To ports of N. O. and Lake Charles and to St. Bd. of Ed. ....	1c
To Parishes (prorated) (collected by State) .....	2c
Federal tax .....	1c

Total tax .....

In addition to the above the City of New Orleans levies additional tax .....

### Equipment—

Owned by L. H. C. ....	\$3,000,000
1939 expenditures .....	250,000

Funds available for new construction in 1939 amount to \$10,739,000 and the volume of work under construction which will be carried forward to 1939 is valued at \$18,963,000.

The principal features of the 1939 program will be the completion of the superstructure and approaches of the Mississippi River bridge at Baton Rouge; the completion of the airline highway between Shrewsbury and Canal Street in New Orleans; the construction of the embankment between Shreveport and Lewis on State Route 8 and the embankment between Boutte and Mississippi River bridge at New Orleans; the construction of numerous bridges and railroad grade separations; approximately 100 miles of concrete pavement and approximately 400 miles of secondary roads.

### Texas

The accompanying tabulations show the mileage maintained by the state highway department on Aug. 31, 1938, which is the end of its fiscal year, contracts let, and construction completed during the fiscal year and active at the end of the fiscal year.

On Aug. 31, 1938, the department was maintaining state highway mileage as follows:

Type	Mileage
Unimproved .....	2,047.60
Grading and small structures .....	1,955.39
Gravel, caliche, etc., surface .....	1,787.04
Asphalt surface .....	10,672.42
Concrete and brick .....	5,003.89
Total .....	21,466.34
City mileage not included .....	592.52
Grand total .....	22,058.86

During the year construction contracts were let covering the following types of highways and bridges:

Type	Mileage	No. of Projects	Cost
Landscape projects .....	10	10	\$ 69,140
Grading and small structures .....	599.30	130	6,744,721
Gravel, caliche, etc., surface .....	658.89	115	4,902,749
Asphalt surface .....	1,168.18	362	7,200,699
Concrete and brick .....	367.40	75	6,453,065



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Elevating Graders

5-Yard Tractor Scraper  
6-Yard Tractor Scraper  
8-Yard Tractor Scraper  
12-Yard Hydraulic Scraper

Railroad relocation .....	1.88	1	53,250
	2,795.65	693	\$25,423,625
Large bridges .....		52	3,624,110
Underpasses and overpasses.....		8	698,670
Total .....	2,795.65	753	\$29,746,406

Relief construction projects started (labor furnished by relief agencies and not included in cost as shown) were:

Grading and small structures.....	131.64	14	\$ 365,728
Gravel, caliche, etc., surface.....	137.33	18	566,502
Asphalt surface .....	14.90	2	51,380
Concrete and brick .....	3.89	2	69,381
Total .....	287.76	36	\$1,052,991
Grand total .....	3,083.41	789	\$30,799,397

Construction completed during the year by types was as follows:

Type	Mileage	Cost
Landscape projects .....		\$ 176,619
Grading and small structures.....	1,019.37	7,354,549
Gravel, caliche, etc., surface.....	640.14	3,825,914
Asphalt surface .....	961.58	6,375,457
Concrete and brick .....	329.58	7,939,701
Grade crossing protection .....		108,063
Total .....	2,950.67	\$25,780,306
Large bridges .....		5,832,578
Underpasses and overpasses .....		1,789,695
Grand total .....	2,950.67	\$33,402,580

On Aug. 31, 1938, projects under construction and active were as follows:

Type	Mileage	Cost
Landscape projects .....		\$ 44,932
Grading and small structures.....	450.94	5,592,024
Gravel, caliche, etc., surface.....	510.41	4,203,202
Asphalt surface .....	577.81	4,228,775
Concrete .....	238.06	3,467,731
Highway planning survey.....		1,382,753
Highway protecting devices.....		285,008
Railroad relocation .....		54,584
Total .....	1,779.10	\$19,259,014
Large bridges .....		6,515,318
Underpasses and overpasses.....		676,524
Grand total .....	1,779.10	\$26,450,857

A forecast for the 1938-39 fiscal year may be summarized as follows:

1. Projects on current construction programs previously approved but not yet placed under contract totaled \$19,033,000, and consist of the following projects, type and mileage:

No. of Projects	Character of Work	Length in Miles
77	Grading and small drainage structures.....	315.9
56	Grading, drainage structures and surfacing.....	332.5
51	Pavement .....	385.3
49	Large structures .....	
233		1,033.7

2. The following are 1940 programs which have been approved by the State Highway Commission, and are subject to approval of the Bureau of Public Roads. The funds for these programs become available July 1, 1939.

#### 1940 REGULAR FEDERAL AID PROGRAM

No. of Projects	Character of Work	Length in Miles	Estimated Total Cost
38	Grading and drainage structures.....	320.7	\$3,591,000
9	Grading, drainage structures and roadbed treatment .....	68.7	1,251,000
10	Grading, drainage structures and surfacing .....	50.9	862,000
36	Pavement .....	375.3	5,324,000
8	Large structures .....		1,248,000
	Roadside improvement .....		124,000

#### 1940 SECONDARY HIGHWAY PROGRAM—TOTALING \$1,860,000 FEDERAL AND STATE FUNDS

No. of Projects	Character of Work	Length in Miles
4	Grading and small drainage structures.....	25.2
19	Grading, drainage structures and surfacing.....	97.4
21	Surfacing .....	125.7
44		248.3

#### 1940 GRADE CROSSING PROGRAM—TOTALING \$1,070,000—ALL FEDERAL FUNDS

No. of Projects	Character of Work	Length in Miles
1	*Grading and small drainage structures.....	11.0
2	*Grading, drainage structures and surfacing.....	5.9
8	Grade separation and approaches.....	...
11		16.9

\*Indicates relocation of the highway to eliminate grade crossings.

Since funds for the 1940 program do not become available until July 1, 1939, projects will be contracted subsequent to that date in a series of monthly lettings.

The amount set aside for the maintenance of state highways in the present fiscal year is \$8,034,155; while the itemized legislative appropriation for administration and expense of the Austin main office is \$630,397.

In addition to these amounts the legislature has appropriated from state highway funds \$755,250 for operation of the state highway patrol which operates under the department of public safety.

Julian Montgomery, Austin, Tex., is state highway engineer.

## MOUNTAIN DIVISION

### Montana

State highway construction costing approximately \$1,734,000 was completed in 1938. In addition 29 bridges costing \$140,000, and 7 grade separations costing \$602,000 were completed. Details of the 1938 work follow:

#### STATE HIGHWAY CONSTRUCTION COMPLETED IN 1938

Type	Miles	Approximate Cost
Graded and drained .....	84.5	\$1,734,000
Gravel .....	101.9	
Bituminous types .....	44.2	
Concrete .....	0.3	
Bridges—number .....	29	140,000
Grade separations—number .....	7	602,000

The uncompleted construction carried over to this year included the following:

#### UNCOMPLETED CONSTRUCTION CARRIED OVER TO 1938

Type	Miles	Approximate Cost
Graded and drained .....	61.7	\$1,290,000
Gravel .....	86.7	
Bituminous types .....	52.7	
Concrete .....	0.1	
Bridges—number .....	28	127,000
Grade separations—number .....	5	307,000

The proposed construction program for the present year is as follows:

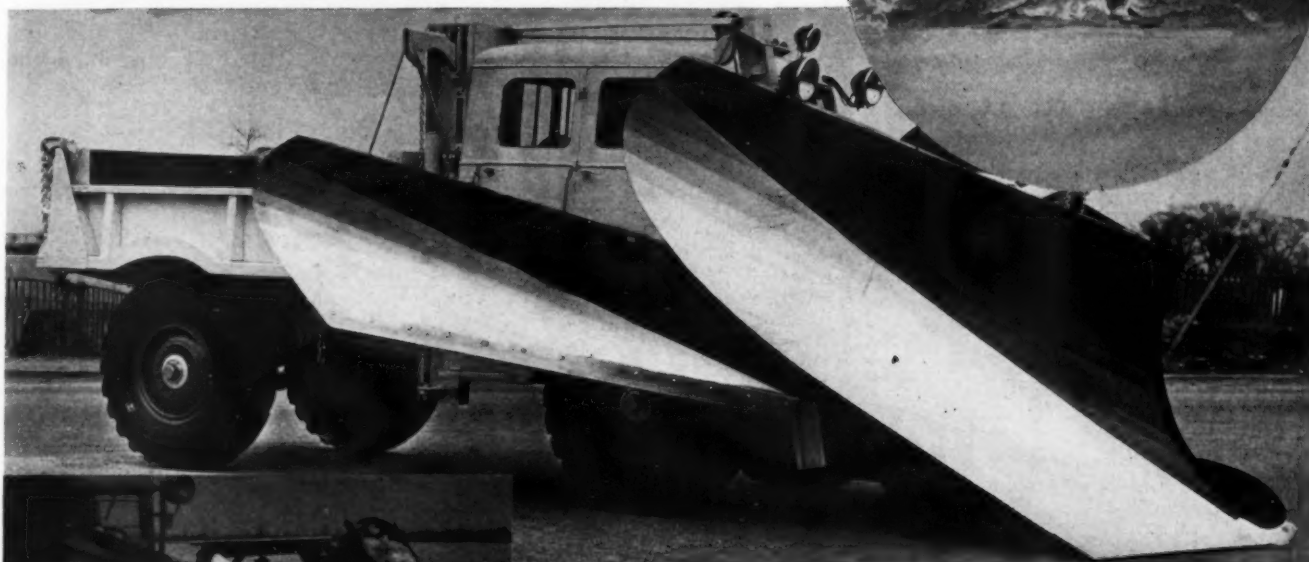
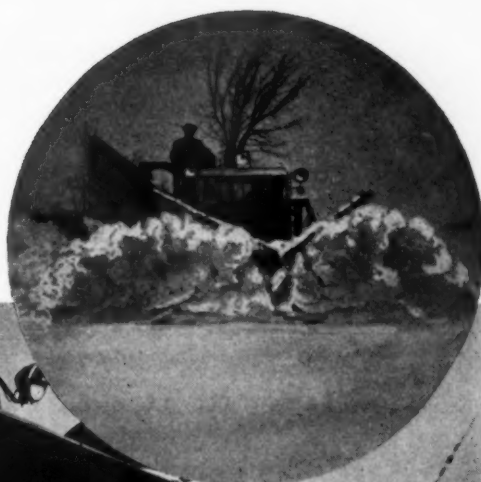
#### PROPOSED CONSTRUCTION FOR 1939

Type	Miles	Approximate Cost
Graded and drained .....	275	\$2,640,000
Gravel .....	325	1,700,000
Bituminous types .....	120	360,000
Bridges—number .....	55	950,000

D. A. McKinnon, Helena, Mont., is state highway engineer.



# When you need *better* than "four-wheel drive"



Walter AXRS Snow Fighter, 200 H.P., 7 to 10 Ton, with Sedan Cab, V Plow, Right Wing, Power Hydraulic Control.

"What is better than 4-wheel drive," you ask? Only one thing — **WALTER FOUR-POINT POSITIVE DRIVE.**

For Walter Snow Fighters and Tractor Trucks are the only vehicles equipped with a differential action that automatically proportions the power among the wheels according to their requirements at any instant. The Walter Patented Automatic Lock Differentials divide the power so that the wheels with least traction get the least and those with the most traction the most power. If one wheel should lose traction momentarily, its mate does not go on a "sympathy strike", but continues to operate under full power.

Walter Snow Fighters, with their superior differential action, unique suspended double reduction drive, exceptionally powerful motors and scientifically correct weight distribution, offer you the greatest possible assurance of open roads and unhindered traffic after heavy blizzards. That is why those communities and fleet owners, exposed to severe winter conditions, find the solution to their problem in **WALTER FOUR-POINT POSITIVE DRIVE.**

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## WALTER MOTOR TRUCK CO.

1001-19 IRVING AVENUE, RIDGEWOOD, QUEENS, L. I., N. Y.

### Idaho

State highway construction costing \$3,810,443 was completed in 1938. Details of this work follow:

#### PROJECTS CONTRACTED IN 1937 AND COMPLETED IN 1938

Grade and drain.....	7.8 miles	\$ 232,994
Grade, drain and surface.....	48.0 miles	627,132
Crushed rock or gravel surf.....	5.5 miles	59,225
Pit run gravel surfacing.....	11.2 miles	17,393
Road mix bit. surf.....	13.5 miles	107,660
1—con. and steel underpass.....	50.8 ft.	58,417
2—con. and steel overheads.....	1,441.4 ft.	247,285
1—con. bridge.....	211.5 ft.	64,716

Total .....\$1,414,822

#### PROJECTS CONTRACTED AND COMPLETED 1938

Grade and drain.....	2.4 miles	\$ 75,542
Grade, drain and surface.....	37.8 miles	501,228
Grade, drain, surface and road mix bit. mat.	10.5 miles	134,620
Crushed rock surfacing.....	26.6 miles	102,591
Road mix bit. surface.....	176.7 miles	642,216
Plant mix bit. surface.....	43.1 miles	320,336
Cement conc. pavement.....	4.9 miles	162,009
Widen and cr. rock surface.....	17.9 miles	177,961
Widening city streets.....	0.15 miles	15,764
Seal coal bit. surf.....	33.2 miles	19,175
Roadside improvement.....	1.1 miles	12,228
1 timber bridge.....	497.5 ft.	23,153
3 steel and conc. bridges.....	883.9 ft.	181,521
1 overhead.....	135.3 ft.	27,277

Total .....\$2,395,621

Projects as follows costing \$1,868,582 had not been completed on Dec. 19 last:

#### PROJECTS CONTRACTED BUT NOT COMPLETED

DEC. 19, 1938

Grade, drain and surface.....	46.6 miles	\$ 845,632
Grade and drain.....	3.4 miles	87,578
Grade, drain, surface and road mix bit. surf.	23.2 miles	313,229
1 overhead.....	193 ft.	44,498
1 concrete bridge.....	1,424.5 ft.	356,149
2 steel and timber bridges.....	1,031.1 ft.	178,196
2 timber bridges.....	731.9 ft.	43,300

Total .....\$1,868,582

The total amount of money available for highway construction during 1939 will be contingent on whether or not the next legislature will pass the \$5.00 motor vehicle license fee and divert 1 ct. of the gasoline tax to the counties. Until such time, it is impossible to forecast the 1939 construction program.

J. H. Semmer, Boise, Idaho, is state highway director.

### Wyoming

State highway construction completed in 1938 included 185 miles of bituminous type. In addition 5 grade separations were completed. The uncompleted construction carried over to 1939 included 30 miles of graded and drained roads and 70 miles of bituminous types.

The 1939 highway program will amount to approximately \$4,000,000, made up of \$2,500,000 in state funds and \$1,500,000 in federal funds.

Expenditures will be approximately \$1,100,000 covering maintenance and overhead, including miscellaneous functions of the department, and the remainder will go for construction.

One hundred and thirty-three thousand dollars will be available for grade crossing elimination from the Federal Government. The total funds, federal and state, for the secondary program will amount to approximately \$300,000 and the Federal-aid projects on the main highways will amount to approximately \$2,000,000. The remainder of the funds will be expended on betterment jobs.

The mileage of work of various types to be done is not as yet available. Probably there will be about 150 miles of oiling work and approximately the same in grading work.

No outstanding projects are contemplated and no doubt the program will include the reconstruction and widening of the heavier traveled roads. Together with a considerable mileage of new construction on previously unimproved roads, which will be additions to the state highway system.

Secondary road construction will consist of continuing the program of constructing short stub or feeder roads leading from the main highway system.

C. F. Seifried, Cheyenne, Wyo., is superintendent-engineer, state highway department.

### Colorado

Expenditures for construction in 1938 amounted to \$13,390,000. A total of 592 miles of highway was rebuilt or improved, and 493 miles were oiled.

The 1939 expenditures will be \$90,000,000 for building 275 miles of highway.

Chas. D. Vail, Denver, Colo., is state highway engineer.

### New Mexico

The total expenditures in 1938 for construction, maintenance and administration amounted to \$8,760,000. In all 710 miles of all type of highway were completed.

The construction program for 1939 is not ready.

### Arizona

It is estimated that the state highway department will have \$4,119,000 for construction in 1939. The total amount available for highways in 1939 is \$6,719,000 of which \$1,500,000 is for maintenance and \$1,000,000 for other purposes. The sources of these funds are as follows:

Federal Aid .....	\$1,967,040
Federal lands .....	151,960
Gas tax .....	3,250,000
Vehicle license fees.....	1,250,000

The estimated construction for 1939 includes the following:

		Estimated Cost
Grading .....	60 miles	\$1,800,000
Surfacing .....	130 miles	1,579,000
Paving .....	8 miles	240,000
Bridges and grade separations.....		600,000

The above information is only an estimate of expenditures for the calendar year of 1939 and includes carry-overs as well as new construction. Definite information regarding the program is not available at this time due to the fact that the budget is compiled in June covering the fiscal year from July 1st to June 30th.

Howard A. Reed, Phoenix, Ariz., is state highway engineer.

### Utah

The following tabulation shows the construction completed in 1938:

#### STATE HIGHWAY CONSTRUCTION COMPLETED IN 1938

Type	Miles	Approximate Cost
Gravel .....	77.522	\$911,415
Bituminous types .....	148.144	935,547
Concrete .....	5.009	193,331
Bridges, number .....	8	141,503
Grade separations, number.....	2	118,192
Roadside development .....	9.156	75,884

The uncompleted construction carried over to the present year is as follows:



# MORE MILES OF ROAD



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ERIE**

*F*OR ROADBUILDING and maintenance work, the peppy, hustling 10-B is the first choice of practical engineers, contractors and highway officials. Fast on-the-job moves are made with traveling speeds to 4 1/4 m.p.h. Fast job-to-job transportation is always available with a platform-type truck or with the special 10-B Trailer. The compactness and short clearance of the 10-B avoids traffic tie-ups and permits normal, high speed operation in narrow lanes and in tight spots. For more miles of road, and more economy in road work, investigate this world's fastest selling 3/8-yard excavator.

## BUCYRUS - ERIE

SOUTH MILWAUKEE, WISCONSIN, U. S. A.

UNCOMPLETED CONSTRUCTION CARRIED OVER  
TO 1939

Type	Miles	Approximate Cost
Gravel .....	63.238	\$1,403,235
Bituminous types .....	6.846	157,750
Concrete .....	19.575	617,580
Bridges, number .....	5	93,405
Grade separations, number .....	2	72,245
Roadside development .....	1.505	12,588
Concrete sidewalk .....	1.620	14,095

It is not possible at this time to outline the proposed construction program for the present year. However, it is expected that the construction budget for 1939 will total approximately \$2,100,000.

Ezra C. Knowlton, Salt Lake City, Utah, chief engineer, state road commission.

## Nevada

The state highway construction completed in 1938 included 217 miles of bituminous types at an approximate cost of \$1,686,474. In addition 58.4 miles of gravel roads were completed at approximate cost of \$333,884; one bridge costing \$8,010; three grade separations costing \$398,254; and one grade crossing signal, \$3,449. The uncompleted construction carried over to 1939 was as follows:

UNCOMPLETED CONSTRUCTION CARRIED OVER  
TO 1939

Type	Miles	Approximate Cost
Graded and drained .....	4.8	\$ 32,330
Gravel .....	9.9	118,157
Bituminous types .....	37.8	547,079
Bridges—number .....	1	35,135
Grade separations—number .....	2	296,502
Grade crossing signals .....	1	3,103

The construction program for the present year includes the following:

## PROPOSED CONSTRUCTION FOR 1939

Type	Miles	Approximate Cost
Gravel .....	28.4	\$ 187,690
Bituminous types .....	108.1	1,618,000
Bridges—number .....	6	*112,000
Grade separations—number .....	1	*17,000
Grade crossing signals .....	14	27,000

\*Includes reconstruction.

Robert A. Allen, Carson City, Nev., is state highway engineer.

## PACIFIC COAST DIVISION

## Washington

State highway work completed in 1938 involved an expenditure of \$8,501,900 and included the following:

## WORK COMPLETED DURING CALENDAR YEAR 1938

	Miles	Value
Grading and surfacing .....	318	\$3,720,500
Cement concrete pavement .....	24	1,067,200
Bituminous surfaces .....	606	1,058,200
Miscellaneous construction .....		33,900
Bridges (number) .....	58	2,298,300
Grade crossing eliminations (number) .....	13	*323,800

Total ..... \$8,501,900

\*Includes structures only.

The uncompleted work under existing contracts carried over into 1939 classified as to type and amount is as follows:

	Miles	Value
Grading and surfacing .....	102	\$1,903,400
Cement concrete pavement .....	7	477,700
Bituminous surfaces .....	69	229,300
Miscellaneous construction .....		18,100

Bridges (number) .....	17	907,700
Grade separations (number) .....	2	*158,000
Total .....		\$3,694,200

\*Includes structures only.

The proposed construction for 1939 classified as to type and amount is as follows:

	Miles	Value
Grading and surfacing .....	386	\$3,244,200
Cement concrete pavement .....	21	744,100
Bituminous surfaces .....	663	1,146,300
Miscellaneous construction .....		416,700
Bridges (number) .....	15	604,700
Grade separations (number) .....	5	300,000
Total .....		\$6,456,000

The proposed expenditure for construction in 1939 as shown above will depend to a great extent upon appropriations and highway legislation which may be acted upon by the legislature, which convenes in January, 1939. It is anticipated, however, that adequate appropriation will be made to enable the department at least to match the regular and secondary federal aid allotments.

L. V. Murrow, Olympia, Wash., is state highway director.

## Oregon

State highway work costing approximately \$5,060,000 was completed last year. The following table gives some details of this work:

STATE HIGHWAY CONSTRUCTION COMPLETED  
IN 1938

Type	Miles	Approximate Cost
Graded and drained .....	91	\$1,210,000
Gravel and crushed rock .....	148	1,100,000
Bituminous types .....	321	1,580,000
Concrete .....	9	300,000
Bridges—number .....	15	440,000
Grade separations—number .....	5	430,000

Total ..... \$5,060,000

The proposed construction for 1939 includes the following:

## PROPOSED CONSTRUCTION FOR 1939

Type	Miles	Approximate Cost
Graded and drained .....	140	\$2,800,000
Gravel and crushed rock .....	170	1,200,000
Bituminous types .....	215	930,000
Concrete .....	10	300,000
Bridges—number .....	15	300,000
Grade separations—number .....	3	350,000

Total ..... \$5,880,000

The above amounts included approximately \$3,000,000 in projects which were let in the fall of 1938.

R. H. Baldock, Salem, Ore., is state highway engineer.

## California

The state of California operates upon biennial periods and budgets for state highway construction and maintenance are upon that basis.

The budget for the coming biennium (July 1, 1939 to June 30, 1941) is now in preparation prior to its submission to the governor and the 1939 session of the state legislature. Definite figures relative to proposed construction to be included in this budget are not available at this time.

C. H. Purcell, Sacramento, Calif., is state highway engineer.





**"PAYING FOR  
DEAD HORSES"**

## never builds a good highway system!

**R**oads that need constant, costly maintenance and reconstruction, keep the taxpayer always "paying for dead horses." Year after year he pays his gas taxes and license fees, yet there's not enough money for needed new highways, widening, grade separations and other permanent improvements.

What a difference when each year's program includes new concrete highways! How they stand out in the midst of other roads! If there's anything calculated to create and keep up public interest in good roads, it's this *contrast* of fine, enduring concrete with makeshift surfacing.

As you get more concrete and less low-type

roads, annual maintenance costs are cut, releasing more and more funds for *new* roads, arterial streets, bridges and grade separations. According to published state highway records, maintenance requirements for concrete average about \$103 per mile per year—\$88 to \$465 *less* than for other surfaces.

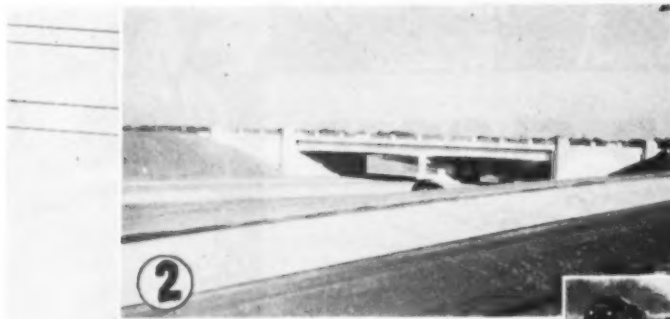
These figures are based on latest official records available January 1, 1937, of all the 21 states publishing comparable data. The periods covered in the various states range from 2 to 16 consecutive years and average 9. Nearly 135,000 miles of state highways are included. Information sheet "Road Surface Maintenance Costs" will be sent on request.

### **PORTLAND CEMENT ASSOCIATION**

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*A national organization to improve and extend the uses of concrete through scientific research and engineering field work.*

# HERE and THERE—1938

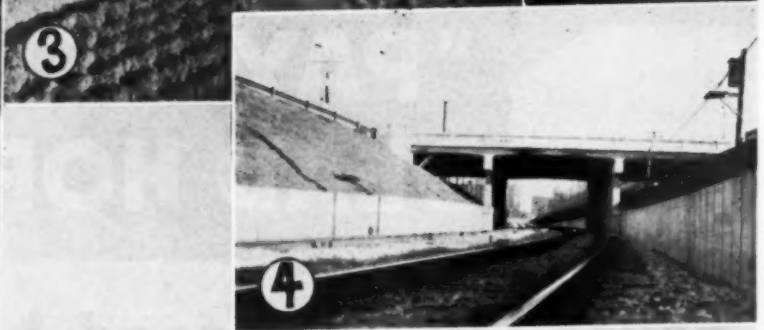


1. Bridge Between Leighton and Weissport, Carbon County, Pa., Completed.

2. Grade Separation on U. S. 40 in St. Louis County, Mo. Note the Pleasing Design.

3. Fill Construction on Route 76 Between Columbia and Sumter, S. C., Over the Wateree River Swamp.

4. De Baliviere Overhead in City of St. Louis, Mo., Over Wabash Railway. Approximately One Mile of Railroad Depressed. Three City Street Overpasses Involved.

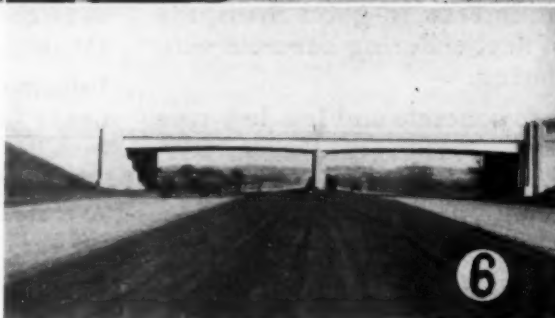


5. Close-up of Photo No. 1, Concrete Handrails Obscure Valley Vistas.

6. Mason Road Overpass in St. Louis County, Missouri, Looking East on U. S. 40. Roadway Grading is 80 to 86 ft. Wide.

7. Another View of Fill Construction Over Wateree River Swamp on Route 76, Between Columbia and Sumter, S. C.

8. Placing Lower 3-In. Bituminous Course of a 6 Ft. Widening on the 11-Mile Divided Highway Between Elk River and Anoka, Minn.





# KOEHRING

*— to get rid of the dirt*

... whether it is a large stripping shovel, or the smallest basement excavator, the Koehring Shovel advantage of *long reach* and *high lift* "gets rid of the dirt".

... crowd the dipper above and beyond the end of the boom ... because of the Koehring positive and independent crowding action. Maximum power is directly available at any point of dipper travel, whether digging or dumping.

HIGH  
LIFT



**KOEHRING COMPANY**  
CONSTRUCTION EQUIPMENT • MILWAUKEE, WISCONSIN



# EDITORIAL

## Test Bridges to Failure

**B** R I D G E engineers of the country might well follow the experimental work on new light weight alloys in progress at the new laboratory of the Massachusetts Institute of Technology. Prof. John B. Wilbur, director of the laboratory of structural analysis, states that studies of bridge stress indicate that many bridges of the present day have to use as much as five-sixths of their strength to support their own weight, allowing only one-sixth for the support of the live load of traffic.

Along with his investigational work on this important subject we suggest he make some cooperative arrangement for the testing of full-sized steel and full-sized reinforced concrete bridges for the purpose of ascertaining justifiable stress values to use in design. It is our contention that design stresses twice, or even more, as large as at present used could be safely employed. Present bridge design is uneconomically heavy.

It may be necessary to build a model, say 20 feet long, to exact proportionate dimensions first, in order to find out what data must be obtained and what procedure of testing should be followed.

Large enough sums are spent for new bridge construction on our highways to justify a full-sized experiment in which the bridge is loaded to destruction. We need more bridges for less money.

## How About a Motor Caravan?

**W** O U L D you join a motorcade, organized on a transcontinental scale, when you go to the annual convention of the American Road Builders' Association at San Francisco, March 7-10? The annual convention of the Associated General Contractors occurs concurrently with the Roadbuilders' convention.

This is merely a request of the editors to see what interest could be expected from such a plan. We ask you to write to us expressing your ideas on the subject. There is nothing official about the plan so far as the American Road Builders' Association is concerned. We believe a motorcade would be a thoroughly enjoyable affair. The historical background of the territory through which the route passed would be explained by folders to be given to motorcade participants at the various local headquarters. Official windshield stickers could be provided, by arrangements with the various states along the route, to be given to those participating, which would protect them along the route.

It is possible that such an idea could be enacted on so large a scale that detachments would have to be organized for separate feeding and lodging in various towns along the route.

If you would join such a caravan in case it is organized, please write the editors before January 20.

## A CONTRIBUTED EDITORIAL

By R. H. BALDOCK

*Oregon State Highway Engineer*

### HIGHWAY SPIRALS

**T** H E first motor vehicles were not designed to be driven at present high speeds, and the highways of that day were built for operation at low speeds. Under such circumstances, transition or spiral curves were not required but, as the speeds increased, transition curves became a necessity in the interest of safety.

When spirals are not used, fast traffic must slow down on entering the curve so as to reduce the effect of centrifugal acceleration which is suddenly applied at the point of the circular curve. However, many people do not slow down—they cut the curve, thus traveling on the path of the spiral curve, which lessens the effect of centrifugal acceleration but places the car on the wrong side of the road and causes a condition that results in many accidents.

When a vehicle enters a 6° curve at 60 miles an hour, the wheel is subject to a radial acceleration of 8.1 feet per second. Investigations disclose that skilled drivers can manipulate a car at the rate of change of acceleration of between three and four. For safety a rate of change of 1.5 is recommended. Under such circumstances, a driver can gain full acceleration without hazard in approximately 5.4 seconds, which requires a transition or runoff curve of approximately 475 feet.

A correctly superelevated, spiraled, long-radius curve can be driven at the design speed of the highway with no more discomfort than is present when driving a tangent. Experience has shown that the use of a spiral is a distinct

advantage in driving and tends to hold a vehicle in its proper lane.

Some people have complained, without apparent justification, that driving on a transition curve necessitates constant adjustment of the steering wheel. The various forces acting upon the car in going around a curve cause the development of slip angles in both front and rear wheels, which slip angles are further dependent upon the condition of the tread of the tire, the degrees of inflation, the nonskid property of the roadway, the weight of the wheel, the tire size, and the loading of the vehicle. The driver must, under such conditions, steer toward the side from which the force is coming until the requisite slip angles are developed to brace the car against the forces. The experienced driver automatically makes the slight adjustment in the steering angle so that the result of all forces acting keeps the car in its proper path. These small adjustments of the steering wheel, through a slight fraction of a degree of arc, are made by the driver without conscious effort.

Steering on tangents is somewhat affected by loose connections and side play in wheel bearings and in the steering mechanism. The centrifugal force acting on the transition curve takes up this lost motion.

Spirals have been used in the state of Oregon for a number of years. The spiraled sections can be driven at a continuous speed over both tangents and curves, whereas on the older sections without spirals the speed must be decreased on entering curves in order to avoid the rapid change in centrifugal acceleration.

## GODWIN'S

### SELF-ALIGNING EXPANSION JOINT ASSEMBLY

1. The Trusses support any size or kind of joint filler in rigid, vertical position.
2. Removable Filler Shield held to line and grade by trusses.
3. Two flat continuous parallel supports equalize the subgrade contour and prevent settlement.
4. Four continuous parallel supports grip the subgrade and prevent any movement. No danger of displacement during the placing and working of concrete.
5. Trusses with narrow horizontal surfaces eliminate the hazards of air pockets and planes of weakness.
6. Uniform and accurately gauged socket clearance.
7. No fastenings and a minimum of socket friction allows each side of assembly to move with shrinking concrete—this prevents checking of concrete.

Rigidly welded assembly assures the necessary alignment and levels of all trusses and filler.

Trusses tested to transmit 12,000-lb. wheel loads in either direction.

Installing an 11-foot assembly requires less than two minutes for one man.



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## "EXTRA INCOME" FEATURES

When you "Buy Michigan" you get EXTRA features for EXTRA income! Truck economy and mobility—Air Controls—high-speed production—Rugged, balanced construction—Quick Change-Over to Clam, Dragline or Trench Hoe.

Earn *extra profits* this year with MICHIGAN  $\frac{3}{8}$  yard and  $\frac{1}{2}$  yard TRUCK SHOVELS-CRANES.

Write today for "WORK BOOK RS".



**MICHIGAN POWER SHOVEL CO.** BENTON HARBOR, MICHIGAN, U.S.A.



## NEW EQUIPMENT AND MATERIALS

### New Medium-Size Motor Grader That Backslopes

A new motor grader, known as the No. 302, has been announced by J. D. Adams Co. of Indianapolis, Ind. It is a medium-size, popular-price machine, which, it is

makes for even smoother, more accurate coverages; keeps abrasives below the runningboard of passing cars. Low center of gravity prevents sideways. Because of the widely varying topography and needs of cities and highways in different parts of the ice and snow belt, both a single spinner and a double spinner model have been developed. The single spinner model has a movable rotatable bottom with one large feed opening which may be located

way. Sides of this unit are cut at an angle so that when the truck body is in high dumping position, the regular tail gate of the truck is flat, affording secure, wide footing. In addition, a guard rail at waist height offers still greater protection for the operator.



*New Adams Medium-Size Motor Grader*

claimed, is capable of building and maintaining roads from bank to bank, including backsloping. The No. 302 is similar in design to the large Adams heavy-duty motor graders and has many of the same features of design and construction. It employs the monomember frame which characterizes other Adams machines and which allows for better blade visibility plus a wider range of blade positions. It is claimed that this is the first motor grader of this size on which the blade can be swung outward to cut high or low backslopes. It is claimed also that the machine's weight is so balanced that more pressure can be exerted on both blade and scarifier, with this machine. The No. 302 is powered by the improved International I-30 tractor, with engine developing 45½ h.p. Three types of drive are offered—two-wheel drive with dual or single tires for strictly maintenance work and Adams four-wheel tandem drive which provides maximum traction for all types of work. Optional equipment includes leaning front wheels, scarifier, canopy top, cab enclosure, starting and lighting equipment, V-type snow plow and snow wing.

### New Sand and Cinder Spreaders

Two new models of their Little Giant sand and cinder spreader for control of icy, skiddy street and highway conditions have been announced by the Portable Elevator Mfg. Co., Bloomington, Ill. This makes the Little Giant available in low wheel, single or double spinner models. All these spreaders have two ground wheels. On the new models the ground wheels are 16 in. in diameter. This reduces the effect of strong winds blowing fine materials;

at any point over the circular spinner so that the spread may be in any direction. The quantity or density is easily controlled by an adjustable slide. By direct-

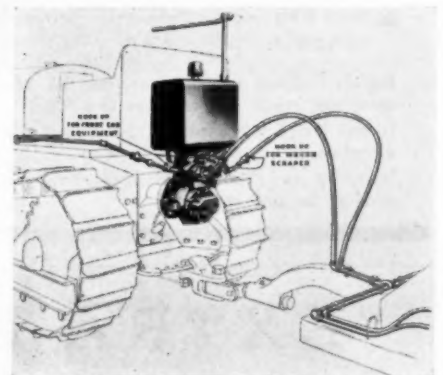


*New Model Little Giant Spreader*

ing the flow of materials to the forward right-hand segment of the counter-clockwise rotating spinner, abrasive is thrown ahead of the rear wheels of the truck and to the left to cover the entire width of an average street or highway. This feature is especially appreciated in hilly territory. The double spinner model is chosen by many municipal street and highway departments where abrasives must be spread in heavy traffic, where there are numerous approaches to intersections to protect, and where extra width is required. A safety accessory is the safety feed gate—a truck tail gate with adjustable feed feature and safety guard rail. It fits any standard truck without altering the body in any

### Continental Be-Ge Power Control Unit Serves Dual Purpose

The Be-Ge hydraulic pump unit made by the Continental Roll & Steel Foundry Co., East Chicago, Ind., designed primarily for furnishing power to the hydraulic jacks that operate Continental wagon scrapers as well as other construction and road building equipment that is hydraulically operated, has been improved and now serves a dual purpose. It is now made with convenient extra outlets for operating tractor front-end equipment such as bulldozers, angle blades, loaders, shovels, etc. It is stated that tractors equipped with front-end equipment can be used simultaneously to pull wagon



*Be-Ge Power Control Unit*

scrapers, it being only necessary to open or close a single valve, depending upon which equipment is to be used.

The pump on the Be-Ge power control unit, which is connected to the tractor rear power take-off, is simple and fool-proof and provides a high volume delivery of pressure. The pump unit operates at zero pressure when not under load. The valve control has a spring loaded neutral return and operates easily because of hydraulic balance. Turning the control lever is easy and may be compared with turning a faucet handle.

### New Development in Underdrains

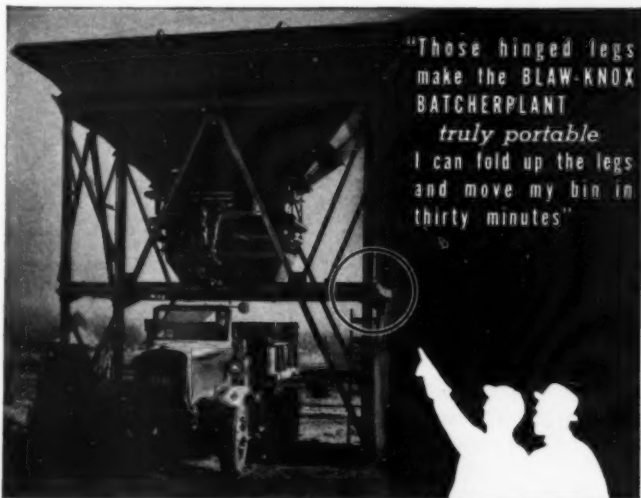
A radically new design in vitrified clay sub-drainage pipe has been announced recently by The Robinson Clay Product Co., Empire State Bldg., New York, and is now on the market under the name "Robinson Skip-Pipe." This new underdrain is of the bell and spigot type, semi-circular in shape. A superimposed cradle is an integral part of the pipe, and is somewhat shorter than the entire length to provide extra rapid drainage under all operating conditions. Skip-Pipe may be used on many

## "A LEADER"



The "FLEX-PLANE" wide screed finishing machine leads the field in producing smooth roads; "one wide screed" cuts the concrete at the same identical place on each pass. Other worthy "FLEX-PLANE" products are joint installing machines and dowel rod spotters.

**FLEXIBLE ROAD JOINT MACHINE CO.**  
WARREN, OHIO



"Those hinged legs make the BLAW-KNOX BATCHERPLANT truly portable. I can fold up the legs and move my bin in thirty minutes"

Only Blaw-Knox Batchplants have hinged legs—a real feature for portability.

When leaving the job—fold up the legs, lower the bin onto a truck or car, and move. No need to dismantle the Weighing Batchers, the entire plant is an integral unit. Setting up the bin is just as easy. They are shipped from the factory that way.

See these interesting plants in Blaw-Knox Catalog No. 1566.

13

**BLAW-KNOX** PORTABLE BATCHERPLANTS  
BLAW-KNOX DIVISION  
OF BLAW-KNOX CO.  
Farmers Bank Bldg. Pittsburgh, Pa.

## MORE YARDS— PER HORSEPOWER



FLAT DIGGING ANGLE MAKES IT EASIER TO FILL THE PAN TO CAPACITY WITH

## BAKER HYDRAULIC SCRAPERS

Flat digging angle and less crowding enable Baker Scrapers to drop more pay dirt on the dump per hour. Less horse power is needed to load them. They dump cleanly, spread evenly and leave a smooth even grade. There's down pressure to cut tough spots. They are cutting costs on many jobs. They can do it on yours.

MODEL 190 SCRAPER, 2½ Cu. Yd. Capacity  
MODEL 210 SCRAPER, 5 Cu. Yd. Capacity



Simply but powerfully built, Baker Hydraulic Bulldozers with direct lift, tremendous down pressure and smooth control are the choice of earth movers for their important jobs.

## BAKER BULLDOZERS

The new and improved models of Baker Bulldozers and Gradebuilders equip them for an even greater variety of work. You can depend on a Baker.

Ask for special Bulletins on  
Baker Scrapers, Bulldozers  
and other Baker Products.

**THE BAKER MFG. CO.**

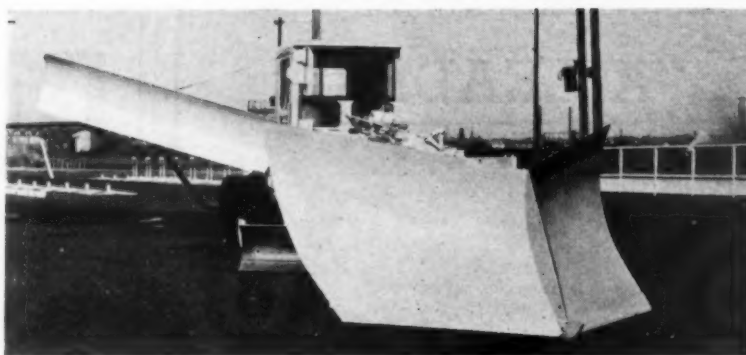
506 Stanford Ave.  
SPRINGFIELD, ILL.



types of jobs, including highway construction, railroad right-of-way, residential cellars, building foundations, sewage disposal plants, athletic fields, airports, or wherever quick underdrainage is essential to normal operation. Robinson Skip-Pipe is manufactured of selected clays, is thoroughly vitrified, and will not rust, corrode or disintegrate. It is available in five sizes from 4 in. to 12 in. in diameter.

#### ▼ New Composite Weighing Batcher

Recently incorporated in a complete central mixing plant furnished by the Blaw-Knox Co., Pittsburgh, Pa., to the Penker Construction Co. for use on the Pennsylvania Ave. bridge project in Washington, D. C., is the newly developed composite weighing batcher illustrated by the accompanying shop photograph. It is a 2 cu. yd batcher for cement and three classes of aggregates. The aggregate bin is a



*New Snow Plow and Mast Type Wing*

is higher than the lower speed plows used on the No. 11 and No. 10 models. The face of the moldboard is painted with aluminum paint which gives a smoother surface for

aluminum reflector, tank connection, swing joint and stand pipe. Height of attachment 12 in. to center of burner; overall height, including tank, 30 in. No. 40T. For use with Type B, 40 cu. ft. Prest-O-Lite Acetylene tanks or tanks of similar size. Equipped with 13-in. aluminum or porcelain reflector, tank connection, swing joint and stand pipe. Height of attachment 18 in. to center of burner; overall height, including tank, 40 in. No. 150T. For use with standard 150 cu. ft. or larger Acetylene tanks (specify tank connection desired; Prest-O-Lite furnished unless otherwise specified). Equipped with 13-



*New Blaw-Knox Composite Weighing Batcher*

three compartment unit of 120 tons' capacity, supplemented by an auxiliary cement pocket of 15 bbl capacity. One of the unique features of this Blaw-Knox proportioning unit is that all filling gates and the discharge are mechanically interlocked. Only one filling gate can be opened at a given time and the batcher discharge gate cannot be opened when any one of the four filling gates is open, or vice versa. All five gate levers may be seen grouped closely together in front of the batcher for the convenience of the operator.

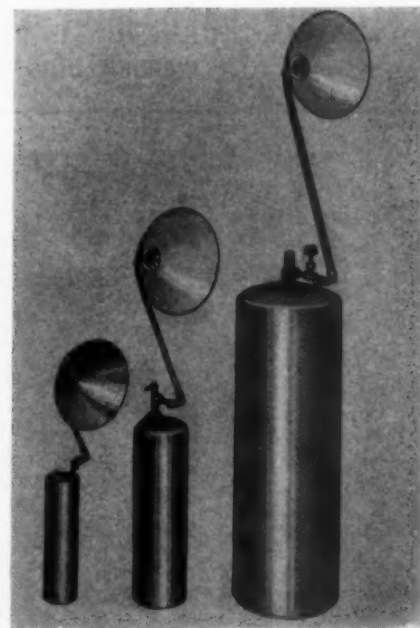
#### ▼ New Snow Plow and Mast-Type Wing

A new V-type snow plow and mast-type wing has been made available for its No. 12 auto patrol by the Caterpillar Tractor Co., Peoria, Ill. The top speed of this patrol is in excess of 15 M. P. H., the 5th speed 9.6 M. P. H. and the 4th 6.8 M. P. H. The new plow has been designed for these higher speeds. The moldboard of the No. 12 V-type plow has more lifting action and

the snow to slide over. The top edge is made readily visible against a snowy background by a strip of red paint. The entire plow is ruggedly constructed. The plow is easily raised or lowered by power control. The rear end raises to the same height as the nose (parallel lift). It has replaceable runners made of cutting edge steel. The mast-type wing is 12 ft. long, heavily braced and, by power controls, either end can be raised or lowered independently, or both ends moved simultaneously.

#### ▼ New Portable Acetylene Flare Lights

Three new portable flare lights have been added to the line of the Alexander Milburn Co., 1493 West Baltimore St., Baltimore, Md. These flares are designed to be used by contractors, railroads, street railways and all industries working outdoors at night. They are furnished in three sizes, as follows: No. 10T. For use with Type MC, 10 cu. ft. Prest-O-Lite Acetylene tanks. Equipped with 10-in.



*New Milburn Portable Acetylene Flare Lights*

in aluminum or porcelain reflector, tank connection, swing joint, gas cutoff cock and stand pipe. Height of attachment to center of burner 28 in.; overall height when used with standard 150 cu. ft. acetylene tank, 66 in.

#### ▼ Simplex Jacks Now Feature Malleable Bases

A new line of malleable base screw jacks has been announced by Templeton, Kenly & Co., Chicago, Ill. The maker states that bases of malleable iron are



# THOUSANDS of MILES of "SAFETY-SURFACED" HIGHWAYS BUILT WITH ETNYRES

● With the New Year comes more new and attractive features which ETNYRE has developed and combined in the 1939 "BLACKTOPPER" Distributor models.

Shown below is an illustration of an ETNYRE "BLACKTOPPER" applying  $\frac{1}{4}$  gal. per sq. yd. finishing coat with 18 ft. spray bar on a Texas highway near Seymour, Texas.

Maximum daily output with no delays has earned the enviable position the ETNYRE "BLACKTOPPER" enjoys with contractors and highway officials thruout the world.



● Photo above illustrates an ETNYRE "BLACKTOPPER" distributor laying the base course on highway No. 277 south of Lawton, Oklahoma.

Application of 1.8 gal. per sq. yd. of 85-100 penetration asphalt heated to 325° F. was made with 24 ft. full width spray bar. Even greater widths of bars are available with an ETNYRE.

Note the uniformity with which the material is applied... typical example of the thousands of miles of "SAFETY-SURFACED" Bituminous highways being constructed annually with ETNYRES.

Manufactured by

## E. D. ETNYRE & COMPANY

Reliable dealers  
thruout United States

Factory and Main Offices  
OREGON, ILLINOIS

Factory Branch  
173 Bent Street,  
East Cambridge, Mass.

A ROYAL WELCOME AWAITS YOU  
AT  
**HOTEL**  
**ANTLERS**



You will enjoy every minute of your stay at the Antlers. It is like living in one's own club. Located near the business district—but away from noise and traffic. Restful sleep in pleasant, well ventilated rooms! Swimming pool and bowling alleys. Wonderful food! In the Meridian Room, Indianapolis' smartest cocktail lounge, you are assured the finest drinks in Indiana.


One of the 16  
ALBERT PICK Hotels  
**200 ROOMS**  
WITH BATH  
FROM **\$2.25**

R. B. ZEIGLER, Manager

**INDIANAPOLIS**  
MERIDIAN AT ST. CLAIR  
OPPOSITE WORLD WAR  
MEMORIAL PARK

"Yes—we get both wet and dry batches from this BLAW-KNOX CENTRAL MIXING PLANT.

It gives us both mixed concrete and dry batches for compartment trucks or truck mixers."



No matter how varied and involved the concrete requirements on your job might be—Blaw-Knox will design a Central Mixing Plant to solve your problems economically.

Stationary or floating plants, manual or automatic in operation, have been furnished for hundreds of jobs. See them in Catalog No. 1566.

**BLAW-KNOX** BLAW-KNOX DIVISION  
OF BLAW-KNOX CO.  
Farmers Bank Bldg. Pittsburgh, Pa.

**CENTRAL  
MIXING PLANTS**



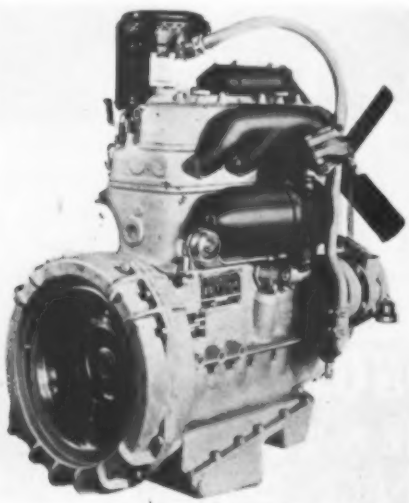
New Line Simplex Jacks

tougher and less subject to breakage due to dropping or rough handling. Jacks are lighter in weight and a peep-hole in the malleable base enables one to see how far the screw can safely be run out. Additionally, the manufacturer claims that friction is reduced 88 per cent because of the floating cap which rests on a chromo-molybdenum steel ball. This cap has a 9° float which completely centers the load. Principal sizes of the Simplex screw jack line are now furnished with malleable bases.

#### Diesel Engine Replacement for Trucks

A Diesel engine replacement for the gasoline engine on Ford trucks has been brought out by the Hercules Motors Corporation, Canton, O. This Diesel engine, which is a completely standardized replacement for the Ford V-8 Truck gasoline engine for the years 1935, 1936, 1937, 1938, 1939, is Model DOOC, four cylinder, 4 in. by 4½ in. This compact, heavy-duty engine develops 70 h.p. at 2,600 r.p.m. Its maximum torque is 162 at 1,400 r.p.m. Its compression ratio is 16 to 1. The replacement can be made without any major changes in the chassis, frame or deck assembly of the truck.

The Hercules Diesel engine is arranged with a special flywheel housing to fit the Ford transmission and is fitted with a special type of front gear cover with supporting arms which duplicate the Ford V-8 front engine mounting. After the complete Ford engine unit has been removed from



The Hercules Diesel.

the chassis the Ford transmission and clutch assembly are attached to the Diesel engine flywheel housing and after the necessary wiring, control unit and similar installations have been made, the Diesel engine with transmission and clutch assembly attached can be placed in the chassis with very little more than is required in installing a standard Ford V-8 engine.

#### WITH THE MANUFACTURERS

##### Charles E. Foote Dies

Charles E. Foote, veteran industrialist and pioneer inventor and president of the Foote Company, Inc., of Nunda, New York, died at his home in Nunda, Saturday, December 31, 1938. Mr. Foote deserves more than passing mention. Coming to Nunda some 40 years ago with his brother, the late Chester T. Foote, he began a career of contracting on small concrete jobs, bidding on this work in the summer time. A small shop was erected on State street at the site of the present Foote plant and during the winter the two boys engaged themselves in experimenting and building gas engines. Out of this experimenting grew what is believed to be the first American road paver. It was known as the Foote No. 3 Continuous. This machine did the work of ten men with their shovels and mixing boards and five years after its appearance, mixing boards on street paving work in the United States had practically disappeared. Charles Foote was known among the road contractors and the cement industry far and wide. Through his efforts and those of his associates, a large organization was built up which was responsible for the present Multifoot Paver and the Adnun Black Top Paver, being used far and wide on both concrete and bituminous pavements. As Mr. Foote had been gradually failing for some time, he had not been active in the business for several years, and his loss will necessitate no changes in the management of the Foote Company, Inc., whatsoever.

##### New Dempster Representatives

Dempster Brothers, Knoxville, Tenn., has announced the appointment of the following equipment dealers to represent Dempster-Dumpsters in exclusive territory: Yancey Brothers, Inc., of Atlanta, for the entire state of Georgia. Ajax Sales Company, Boston, Mass., for the six New England states. Choctaw Culvert & Machinery Co. of Memphis, Tenn., for West Tennessee and the entire state of Arkansas. Dempster-Dumpster Sales Corp., 549 West 54th St., New York City, for states of New Jersey, New York and Pennsylvania. Hunter Tractor & Machinery Co. of Milwaukee, Wis., for Wisconsin and the upper peninsula of Michigan. C. T. Johnson, 4358 Coolidge Ave., Minneapolis, Minn., the entire states of South Dakota and Minnesota. W. H. Gelatt, 922 West 30th St., Des Moines, Ia., entire central and eastern section of state of Iowa.

##### New Dealers for Bay City

As Bay City Shovels, Inc., Bay City, Mich., complete their most successful year of business, having shipped more machines during 1938 than in any previous year of their 25 years of building excavating equipment, they announce several new dealer appointments: Henry H. Meyer Co., Inc., 110 S. Howard St., Baltimore, Md., will represent Bay City convertible shovels—made in capacities ranging from ¾ to 1¼ yd., including both crawler and truck mounted units, as well as trailers and dragline buckets in the state of Maryland, District of Columbia and the four northern counties of Virginia. State Equipment Co., 25 Third St., Parkersburg, W. Va., will handle the complete Bay City line in the state of West Virginia, except Hancock, Brooke, Ohio and Marshall counties. Long-Lewis Hardware Co., Bessemer, Ala., are newly appointed distributors in central Alabama. General Supply Co. of Canada with offices at Montreal, Toronto and Ottawa, have added the Province of Quebec to this territory for the complete line of Bay City equipment including convertible shovels, trailers and dragline buckets.

##### E. Watson Assigned to Worthington Atlanta Office

Worthington Pump and Machinery Corporation, Harrison, N. J., has announced the transfer of Mr. Edward Watson, refrigeration and air conditioning engineer, from the corporation's home office at Harrison, N. J., to its Atlanta District sales office. Mr. Watson will function in North and South Carolina, Georgia, Florida and Alabama. For several years the Canadian representative of the Carbondale Machine Co. of Carbondale, Pa., Mr. Watson joined the Worthington organization when the Carbondale Machine Co. became part of Worthington in 1934. During 1936 and the greater part of 1937, he was located in South Africa, engaged in the promotion of Worthington-Carbondale equipment in conjunction with the Worthington representative there. Since his return, he has been in charge of the Worthington-Carbondale Industrial Refrigeration Division with offices at Harrison, N. J. Mr. Watson's new headquarters will be at 133 Carnegie Way in Atlanta, Ga.

##### Klaus Made District Sales Manager for FWD

R. H. Schmidt, general sales manager of The Four Wheel Drive Auto Co., Clintonville, Wis., recently announced the appointment of Walter G. Klaus as district sales manager in the states of Minnesota and North Dakota, where he will supervise sales work among the FWD dealers in the territory. Since October, 1934, Mr. Klaus has been in the company's employ as assistant to S. H. Sanford, manager of the dealer division, and prior to that time had considerable sales experience. Mr. Klaus and his family have taken up residence in Minneapolis, Minn.



### Great Lakes Supply Co. Appointed Distributor for Osgood, General Excavator and Hercules

The Great Lakes Supply Co., 824 West 36th St., Chicago, Ill., has been appointed distributor in the northern half of Illinois and in the counties adjacent to Chicago territory for the products of the Osgood Co., the General Excavator Co. and the Hercules Co., all of Marion, O.

### Goodrich 20-Year Group Now Numbers Over 2200

When the ninth semi-annual pin presentation ceremonial of the Twenty Year Service Club of the B. F. Goodrich Company was held at Akron, O., recently, records of the club showed that over 2,200 men and women who have been with the company one-fifth of a century or longer are now on its rolls. President S. B. Robertson of Goodrich presented 139 pins to the latest group, those who have completed their 20th service anniversaries since last June at the ceremonies. He also awarded 30-year pins to 222 employees who have more than 30 and less than 40 years of service, and two 40-year pins to employees who have recently entered this classification.

### Scintilla Now Division of Bendix

Effective January 1, 1939, the Scintilla Magneto Co., Inc., Sidney, N. Y., became Scintilla Magneto Division of Bendix Aviation Corporation. This is a change in name only. No change is contemplated in the management, policies or personnel of the present Scintilla organization.

### Barber Asphalt Completes \$250,000 Office Building

Barber Asphalt Corporation has completed construction of additional office building space, with added equipment, at a cost approximating a quarter of a million dollars, providing for removal of the general offices from Philadelphia to the plant at Barber, N. J. The new addition is to the building fronting State St., in Barber, N. J., located on the Central Railroad of New Jersey in the northern limits of Perth Amboy. Removal of the administrative offices from Philadelphia where they have been for the last 25 years is in the interest of efficiency and economy, according to James E. Auten, president of the corporation.

In announcing the removal, Mr. Auten said, "Our administrative and plant facilities have been separated for many years and there was no good reason for this practice. Absentee management does not make for efficient conduct of manufacturing operation. This move means that we are all to become a part of the Barber community and that management and operation are to be more closely co-ordinated."

Mr. Auten indicated with pointed significance that the present concentration of forces and expansion of activities were in anticipation of definitely improved eco-

nomie conditions generally and increased business, specifically for Barber asphalt, and that the outlays already made were possibly only the forerunner of additional and larger expenditures.

The new building on State St. doubles the present office space, and with the addition now is 259 ft. long with a 50-ft. depth, giving a total of 42,000 sq. ft.

According to Joseph Slutzker, works manager, rearrangement of space in the new building will transfer the laboratory staff from the second floor to the ground floor where additional equipment has been installed; the first floor will be occupied by plant executives and the sales organization; the second floor will house the

accounting and auditing departments and the treasurer's staff while the third floor will be for the executive officers.

The Barber plant includes three distinct operations at the New Jersey site: the asphalt refinery located on the east of State St. and fronting Staten Island Sound where also are located the piers for docking and unloading raw materials from Trinidad; the oil refinery and the roofing manufacturing plant located toward the west, with the latter fronting on the Pennsylvania Railroad at Genasco station. The plants, in addition to the pier facilities, where there is 30 ft. of water for the liners and tankers, have available shipping services from the Cen-

**HERE'S THE MOST PRACTICAL  
HIGHWAY MOWER THAT EVER  
CAME DOWN THE PIKE!...**



## SILVER KING

Years of experience and hundreds of owners prove without a doubt, the Silver King Highway Mower does an outstanding job the year around. In addition to the annual Spring-to-Fall weed mowing job, it is an ideal maintenance unit. It is also used for leaf removal in the Fall, snow removal in the Winter. Cities, counties and states all find the Silver King the first practical all-purpose mower. Without obligation, send for the Silver King Bulletin, "For Year 'Round Economy."

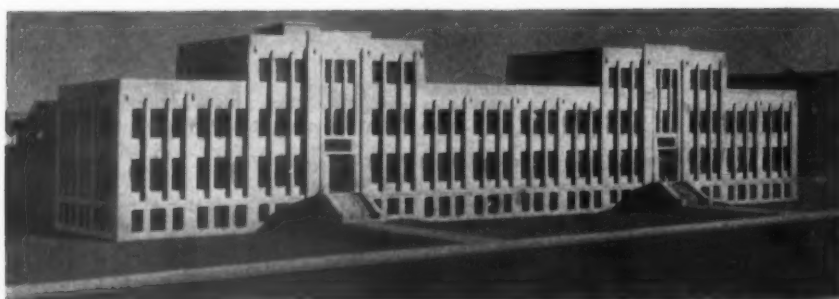


**THE FATE-ROOT-HEATH COMPANY**  
PLYMOUTH, OHIO

**Send for this FREE FOLDER!**







*Addition to General Offices of the Barber Asphalt Corporation Doubles Capacity and Provides Space for Administrative Staff Removed from Philadelphia to Barber, N. J.*

tral of Jersey Railroad, the Pennsylvania, and the Lehigh Valley.

"In all," said Mr. Slutzker, "the three divisions of the Barber operations are spread over about 275 acres of ground. There are approximately 750 employees in the three plants and the augmented office forces, when the removal from Philadelphia is completed, will be between 125 and 130."

Mr. Auten, for many years an outstanding figure in the automobile industry, has been president of the Barber Corporation since May 1, 1936, while Mr. Slutzker, formerly with the Pennsylvania Railroad, has been with the Barber Corporation for 18 years.

#### **Cummins Engine Company Appoints New Sales Manager**

Mr. P. E. Letsinger, vice-president of

Cummins Engine Co., Columbus, Ind., well-known builders of automotive, industrial, and marine diesel engines, announces the promotion of Mr. Dave Buttles of Seattle, Wash., to national sales manager with headquarters at the home office. For the past four years, Mr. Buttles has been the factory sales and service manager for eleven western states. He has been largely responsible for building the present strong position of Cummins Diesels in the marine field in the



*Dave Buttles*

Pacific Northwest. His field trips have taken him from Alaska to Hawaii and among the larger contractors, loggers, and truck fleet owners from Los Angeles to Vancouver, Mr. Buttles is known as just "Dave." Although his host of friends on the Pacific Coast will miss his cheerful, winning personality, they are glad to see his work rewarded by this promotion and know that the Pacific Coast will have a strong ally, familiar with their problems, at the Cummins factory. One of Mr. Buttles' outstanding characteristics is his ability to impart his knowledge to others... to completely familiarize every man who buys a Cummins Diesel with his engine so that he will get the most efficient service from it. In Seattle, Mr. Buttles succeeded in surrounding himself with men who will make every effort to maintain the sales and service records he has set. Mr. Buttles' record as service manager for one of the large diesel truck fleets on the Pacific Coast attracted the attention Cummins Engine Co. Starting as an employee with such a rich background of service, Mr. Buttles developed into an outstanding salesman. He knows the Cummins Diesel from top to bottom and is thoroughly familiar with all sales or service problems.

#### **Evans Products to Manufacture and Sell Vitralux Marker**

Through a contract just concluded with the Vitralux Corporation of America, Evans Products Co., Detroit, Mich., has acquired sole manufacturing and sales rights for the Vitralux safety highway marker for 39 states and the District of Columbia. This new type of patented highway marker, the development of a French inventor, is stated to provide positive illumination of highway borders and to clearly define curves by means of specially designed glass reflector buttons. These reflector buttons, it is claimed, pick up the light from an approaching car's head lamps and reflect it with undiminished brilliancy, even in foggy or rainy weather, giving the effect of a lighted highway. The standards in which the reflector buttons are encased are placed about 100 ft. apart on each side of the highway. Plans for immediate marketing of this new highway marker are being completed and a number of miles of demonstration installations in various states are being arranged.

#### **New Emsco-Buckeye Traction Ditcher Set-Up**

Announcement has been made of arrangements between The Buckeye Traction Ditcher Co., Findlay, O., and The Tractor Equipment Division of The Emsco Derrick and Equipment Co. of Los Angeles, Calif., under which The Buckeye Traction Ditcher Co. is now manufacturing and selling Emsco Tractor equipment in all territory in the United States and Canada, east of the 100th meridian. The Emsco line includes, in addition to the Emsco hydraulic controlled trailbuilder illustrated, cable controlled trailbuilders, hydraulic and cable controlled bulldozers, rippers and scrapers to 12-yd. capacity;

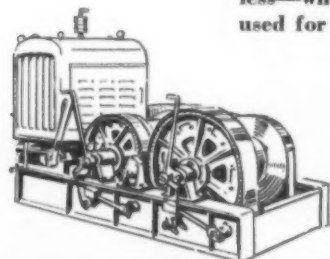
## **SAUERMAN LONG RANGE MACHINES**



Scraper bucket for dragging materials over the ground.



Slackline bucket for hauling materials to high dumping point.



Improved Two-Drum Hoists for economical high-speed operation of Scraper and Cableway Units.

**M**ORE contractors are proving every day that Sauerman machines make easy work of many excavating contracts that would be complicated and costly by any other method.

Wherever earth is to be moved any distance beyond the reach of a boom or dipper-stick, a Sauerman machine has an advantage because it is able to dig, haul and place the material in a straightline operation, doing away with the expense of rehandling.

The equipment investment generally is less, the operating expense always less—when a Sauerman machine is used for these long range jobs.

Tell us about your problem and we will offer our advice on equipment. Catalog illustrating several hundred typical installations mailed free.

**SAUERMAN BROS., Inc.**  
488 S. Clinton St. CHICAGO



Sauerman Slackline Cableway moves gravel from deep under water to top of screening plant.



Mobile Scraper unit drags gravel from middle of river and builds a long, high dike.

sheepsfoot tamping rollers, Garner tractor shovel. The Emsco power control units built for Emsco equipment are also available as a separate item for use with other types of equipment and with any standard tractor. Sales and service will be handled through the Buckeye organization in all territory roughly defined as lying east of Laredo, Tex.; Dodge City, Kan.; Broken Bow, Neb.; Gettysburg, S. Dak., and Rugby, N. Dak. All of Oklahoma except the three western counties is included.

#### ▼ McGehee Appointed Manager of Sales Highway Products Division Truscon

C. B. McGehee, formerly district sales manager in Dallas, Tex., for Truscon Steel Co., has been appointed manager of sales, Highway Products Division of Truscon Steel Co. Mr. McGehee has been connected with the Truscon Steel Co. since 1928. In 1928-30 he was chief engineer with office at the Atlanta, Ga., office. In 1930-1936 he was sales manager at Atlanta, Ga., and from 1936 to Dec. 1, 1938 he was district sales manager at the Dallas, Tex., office. Mr. McGehee was graduated from Georgia Tech in 1925. On May 16, 1936, he married Laura Hoke, daughter of Dr. Michael Hoke, formerly chief surgeon, Georgia Warm Springs Foundation.



C. B. McGehee

#### ▼ Worthington Appoints New Assistant General Sales Manager

Worthing Pump and Machinery Corporation, Harrison, N. J., has appointed Mr. Walter B. Strong to the position of assistant general sales manager. Formerly manager of the corporation's Export Division, in his new assignment Mr. Strong will continue general supervision of export sales, and will also be identified with certain phases of domestic sales work. He is a graduate of Massachusetts Institute of Technology, Class of 1917, and has been a member of the Worthington organization since 1920. Mr. George Gellhorn, Jr., will succeed Mr. Strong as manager of the Export Division. In his new position Mr. Gellhorn will have direct responsibility for all of the corporation's export sales activities.

#### ▼ Gamble Now Secretary and Chief Engineer Ohio Paving Brick Mfrs. Assn.

Victor K. Gamble became secretary and chief engineer of the Ohio Paving Brick Manufacturers Association, which is the Ohio region of the National Paving Brick Association, on Dec. 15, 1938. Mr. Gamble secured his education in civil engineering at the Ohio State University. After leaving the university he was employed by the contracting firm of Fritz-Rumer-Cooke Co.

as material and cost engineer for a short time before entering the service of the Hocking Valley Ry. (now the Chesapeake & Ohio Ry.) as an engineer on construction work. In 1931 he began his services with the Ohio state highway department as assistant materials and testing engineer, resigning to accept his present position. Most of the new developments in the design and construction of brick pavements in Ohio have been under his supervision. Mr. Gamble is a registered engineer and surveyor and is a member of the Ohio Society of Professional Engineers. He is also vice-president of the Engineers' Club of Columbus, in which he has been very active. At the university he was prominent in extracurriculum and athletic activities, and won the distinction of being elected to Bucket and Dipper, men's junior honorary society. In 1928 he won varsity "O" as football manager and was made a member of Scarlet Key. His office is in the Hartman Building, Columbus, O.

#### ▼ Hercules Tire and Tool Pack Contest Award

A \$25.00 prize was offered by the Hercules Steel Products Co. of Galion, O., for the best list of articles which can be carried advantageously in the Hercules tire and tool pack compartment, mounted under the front of the dump body; and for a statement by the contestant regarding what he considered to be the chief advantages of the tire and tool pack. This contest was for the duration of the National Motor Truck Show. First prize was won by Leon H. Zele of the Zele Chevrolet Co., Torrington, Conn. Following is a list of the various equipment named by the contestants as their choice of articles to be carried in the Hercules tire and tool pack compartment under the dump body:

Screw Driver	Emergency Clothing
Stillson Wrench	Ropes
Spare Tire	Drills
Extra Tube	Pinch Bar
Tire Iron	Grease Gun
Tire Spreader	Grease Can
Lug Wrench	Friction Tape
Tow Chain	Punch
Skid Chains	Gasoline
Pump	Spark Plugs
Tackle	Broom
Cement Bags	Pick
6-ft planks	Jack
Waste or cloth	Flares
First Aid Kit	Red Lanterns
Assorted Cotter Keys	Distress Flags
Chisel	Flashlight
Tire Valve Kit	Lunch Box
Logging Chain	Hoe
Hammer	Crowbar
Shovel	Pulleys
Overalls	Air Hose
Soap	Oil Can
Towel	Quart Oil
Shoes	Head Light Kit
Hat	Assorted Bolts
Rain Coat	and Washers
Gloves, Leather	Block and Fall
Jacket	Generator Brushes

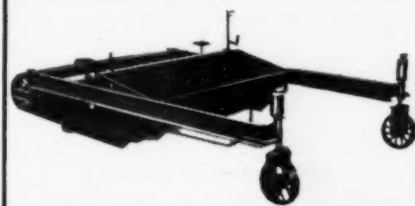
#### ▼ Harnischfeger Appoints McGredy

R. H. McGredy, for many years a sales executive of the Harnischfeger Corporation of Milwaukee, has been appointed manager of the Harnischfeger Washington office where he will direct the sales of the many machines in the P&H line—including overhead traveling cranes, electric arc welders, excavators, hoists, electric motors, etc. Mr. McGredy is now residing at R.F.D. No. 1 in Alexandria, Va. His phone number is Alexandria 366J1-2.



Handles all types of road surfacing and base material with greater speed and in accurate volumes. It spreads and automatically grades in one operation and there are no low or high spots when resurfacing.

The new D-K Spreader and Finisher and Bituminous Paver means profits to the Contractor because of its economical operation and satisfaction to the Highway Engineer because of the uniformity and smoothness of the completed job.



Lays any type mix, hot or cold. Lays any thickness desired. Levels without forms. Lays variable widths from 6 ft. to 10 ft. Lays to grade capacity 1000 to 1200 tons per day.

Lays smoother roads faster and cheaper than machines twice the cost.

THE  
**SHUNK MFG.**  
COMPANY  
BUCYRUS, OHIO.



### W. O. Bates, Jr., Appointed Vice-President Caterpillar Tractor Co.

Mr. W. O. Bates, Jr., who recently was transferred from the San Leandro, Calif., offices of Caterpillar Tractor Co., to become head of the Patent Department at Peoria, has been appointed a vice-president of the company. The appointment was made at a meeting of the Executive Committee, held Nov. 16th in Peoria. Mr. Bates is a graduate of Cornell University with a degree of Mechanical Engineering. Immediately after his graduation, he joined his father and brothers as an executive of the firm, The Bates Machine & Tractor Co. of Joliet, Ill. This pioneer company, manufacturer of the "Bates Steel Mule," a track-type tractor, had been founded by his father in 1880.



W. O. Bates, Jr.

During the World War, Mr. Bates was awarded a commission as captain in the engineering division of the Ordnance Corps, and played an important part in connection with the design and construction of tractors and gun mounts for field and coast artilleries. At the close of the war, Mr. Bates returned to his father's company as director of engineering and service, and continued in that capacity until 1934, although the Bates Company had been purchased by the Foote Bros. Gear and Machine Co. in 1929. After leaving Foote Bros., Mr. Bates opened his offices as patent consultant, with headquarters in San Francisco and Chicago.

### 695 Years of Service

Talk that men past 40 have small chance in today's industry is largely based on the assumption that the elder workers have been abandoned or shunted to the pension rolls before their days of productive labor are over. A substantial argument in the negative has recently been provided by the Hazard Wire Rope Division of the American Chain & Cable Company, Inc., Wilkes-Barre, Penn. This wire rope company comes forward with the statement that its payroll carries the names of 14 employees, each with individual records of from 40 to 67 years of service, these men collectively representing a total of 695 years of continuous employment with one organization. The accompanying illustration shows eight of the fourteen Hazard oldtimers. Left to right in the back row: Philip Henery, 46 years of service; George Hoats, 67; Wally Schuler, 49; Pat O'Toole, 57. Front row: Pete Swineburne, 56; Hugh Murray, 50; Tony Blaum, 49; Bill McCarthy, 45. Not shown in this picture because their duties take them away from Wilkes-Barre are six other Hazard wire rope men: Fred Walter, with a service of 56 years; Benjamin J. Hill, 49; Philip Schumacher, 47; George D. Wicks, 43; Robert A. Stucke, 41, and Fred Vogel, 40.

### NEW LITERATURE

**New Service for Contractors**—A new free service for contractors in the form of an improved Time Book, embodying a complete office, field and Social Security wage record, is announced by the Universal Atlas Cement Co. "This new 48-page Time Book has all the information a contractor needs to keep his time and wage records and Social Security data as to taxes, tax deductions and tax exemptions," the announcement says. "It is good for field or office use, or both. The book fills the need of both large and small contractors and is adaptable to any system used by the contractor. Pay day and pay interval can be according to any contractor's present practice. Either weekly or continuous time records may be kept without rewriting names or employees." The book, which is copyrighted, was developed in cooperation with timekeepers, auditors, contractors and Social Security officials. Contractors may obtain free copies by writing the Universal Atlas Cement Co., 135 East 42nd St., New York, N. Y.

**Wire Rope for Contractors**—A new catalog devoted especially to wire rope for the contracting field has been published by Broderick & Bascom Rope Co., St. Louis, Mo. This booklet contains not only the usual price list but also has many pages of data as to stresses in suspended cables, stresses in hoist and incline ropes, and specific recommendations as to grades and constructions of rope for various types of power shovels, cranes and other equipment; as well as a paragraph on the causes necessitating the premature discard of rope. Copies may be obtained from the main office of Broderick & Bascom Rope Company, at St. Louis, Mo., or branches at New York, Chicago, Houston, Seattle or Portland.

**Concrete Mixing in Cold Weather**—Littleford Bros., 454 E. Pearl St., Cincinnati, O., has issued a handy temperature table for cold weather concreting operations. The table contains information on heating materials, mixing and protection at various temperatures.

**Tar and Asphalt Kettles**—A new circular on its oil burning tar and asphalt kettles has been issued by the White Manufacturing Co., Elkhart, Ind. The various kettles are illustrated and described and concise specifications are given.

**Wagon Scrapers**—To supplement their recent bulletin on road building jobs, the Continental Roll & Steel Foundry Co., East Chicago, Ind., has just issued an interesting bulletin entitled "For Unusual Jobs Too" showing 4, 5, 7 and 10 yd. Continental wagon scrapers at work on mine stripping, golf course and airport leveling, truck loading, channel cleaning and other unusual jobs, many of which have never been done before with wagon scrapers.

**"Leak-Loss" Chart**—The distinctive feature of a new catalogue brought out by M. B. Skinner Co., South Bend, Ind., is a "leak-loss" chart which embodies graphic information valuable to anyone operating

pipe lines. This chart shows how much steam, water, oil or air escapes from various size leaks in pipe, under various pressures. Figures show what these leaks cost at various unit prices and thus one can visualize the tremendous losses which can occur from what are often thought to be harmless leaks. Nine different styles of pipe repair clamps, for stopping leaks without replacing pipes, are shown in this catalogue, under their trade-mark "Skinner-Seal."

**Earth Drill**—The Buda Co., Harvey, Ill., has just prepared a new 8-page bulletin describing the Buda-Hubron earth drill. This machine is used for drilling holes up to 42 in. in diameter, or to 50 ft. in depth. The bulletin contains many illustrations showing the wide variety of uses—such as pole line construction, foundation work, pre-boring for piles, guard rail installations, blasting operations, and pipe line work.

**Shovel and Dragline**—The Harnischfeger Corporation, 4400 W. National Ave., Milwaukee, Wis., have just completed preparation of Bulletin X-50, a catalog on the P&H Models 1055 and 1055-LC—3 cu. yd. power shovel and dragline, respectively. This bulletin gives comprehensive information on the design, special features, and operation of these machines—simply, clearly, with an eye toward presenting all pertinent information, without embellishment, under one cover.

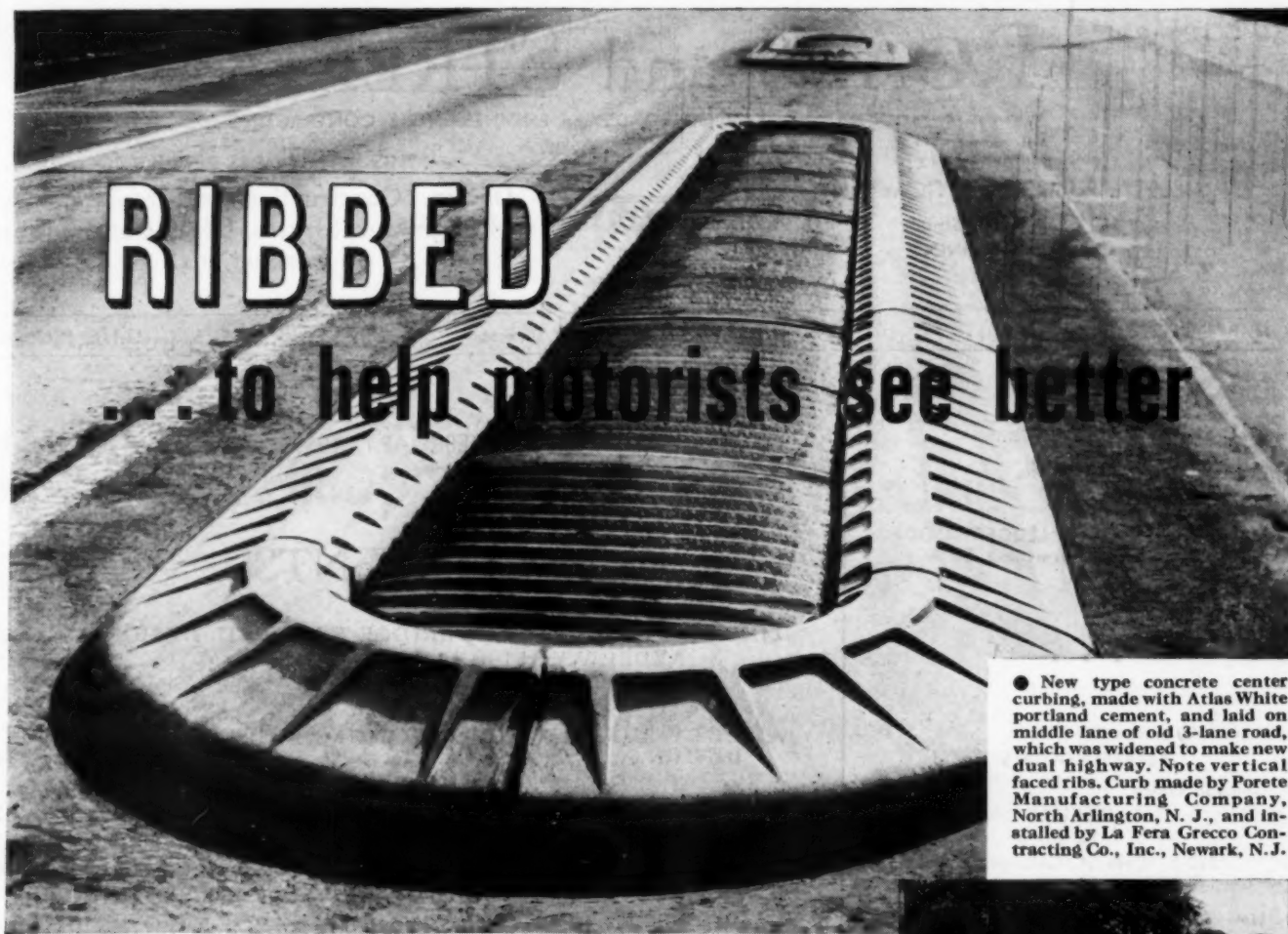
**Air Compressors**—Sullivan Machinery Company, Michigan City, Ind., has recently issued a new catalog describing their large semi-portable air compressor, the WN-102.

This piece of literature shows complete specifications of the three sizes available (445, 550 and 720 cubic feet per minute actual delivery); tables showing the number of tools which can be operated from each size; photographs of direct connected V belt driven models with gasoline, diesel and electric drive; numerous photographs showing the WN-102 at work on road construction, tunnel driving, dam construction, and at mines and quarries.

**Snow Plows and Spreaders**—The Good Roads Machinery Corporation, Kennett Square, Pa., has issued three new bulletins covering various items in its line of snow plows and spreaders. One bulletin deals with plows for 1½-2 ton trucks and another with plows for 5-10 ton trucks. The company also has for distribution a 68-page snow plow catalog fully illustrating and describing the complete line of Good Roads Champion snow plows.

**Truck and Trailer Size and Weight Restrictions**—The Four Wheel Drive Auto Co., Clintonville, Wis., has issued its 1939 edition of its handbook, Truck and Trailer Size and Weight Restrictions, covering the regulations on these points of each state. Extreme diligence was exercised to eliminate errors in this compilation of the laws and regulations limiting the size and weight of trucks and trailers by securing the cooperation of responsible officials in each state, who have checked and approved the laws of their respective states.





# RIBBED

## ...to help motorists see better

● New type concrete center curbing, made with Atlas White portland cement, and laid on middle lane of old 3-lane road, which was widened to make new dual highway. Note vertical faced ribs. Curb made by Porete Manufacturing Company, North Arlington, N. J., and installed by La Fera Grecco Contracting Co., Inc., Newark, N. J.

### Driving at night and in rain or fog made safer by new type of white concrete curbing, on New Jersey Route 29

**H**ERE'S a new type of construction to make driving safer—center curbing with vertical faced ribs. It carries the safety features of white concrete a step farther—particularly for night driving. The ribs increase visibility by reflecting car lights back toward the motorist. In fog and rain they help to make driving easier and safer.

The State of New Jersey has given this new precast safety curb, made with Atlas White portland cement, a severe test—a year's use on one of the heaviest travelled routes leading into New York City. Result: Other similar projects are planned this year. Wherever existing highways are being improved

and widened, this new concrete curbing can be installed easily and economically.

Highway officials know the advantages of white concrete curbing and markers, which give permanent visibility and require no maintenance. They do not need repainting. There are no repairs or replacements. Installation is simple. No specially trained labor is needed.

Here's a suggestion. Keep traffic running smoother; eliminate maintenance costs; reduce accidents—all with Atlas White Cement. Universal Atlas Cement Co. (United States Steel Corporation Subsidiary), Chrysler Building, N. Y. C.



*These precast sections of concrete curbing, made with Atlas White portland cement, were moved easily to the job.*



*Installation was quick, simple...no specially trained labor needed. The large picture at top shows the completed curbing... There's no maintenance when this job is finished.*



RS-M-2

ATLAS **WHITE** PORTLAND CEMENT FOR MARKERS AND CURBS

# ROADS and STREETS

With which have been merged GOOD ROADS and ENGINEERING & CONTRACTING

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H. P. GILLETTE, Editor

V. J. BROWN, Publishing Director

E. S. GILLETTE, Publisher

C. T. MURRAY  
Managing Editor

J. C. BLACK  
Field Editor

D. G. LEDGERWOOD  
Advertising Editor

• • •

## REPRESENTATIVES

### Chicago Office

E. C. KELLY  
E. V. PERKINS

330 S. Wells St., Chicago, Ill.  
Telephone: Harrison 1843

### New York Office

J. M. ANGELL, JR.  
T. F. KILROE

155 East 44th St., New York, N. Y.  
Telephone: MUrrayhill 2-6023

### Cleveland Office

B. C. BRUMM

1601 Leuderdele Ave., Lakewood, Ohio  
Telephone: Lakewood 4466

### San Francisco Office

DON HARWAY & CO.

155 Montgomery St., San Francisco, Cal.  
Telephone: EXbrook 6029

### Los Angeles Office

DON HARWAY & CO.

318 W. Ninth St., Los Angeles, Cal.  
Telephone: TuckeR 9076

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